NOAA Technical Memorandum NOS ORCA 91

# Evaluation of the Condition of Prince William Sound Shorelines Following the Exxon Valdez Oil Spill and Subsequent Shoreline Treatment:

## Volume I 1994 Biological Monitoring Survey

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NOAA Technical Memorandum NOS ORCA 91

# Evaluation of the Condition of Prince William Sound Shorelines Following the Exxon Valdez Oil Spill and Subsequent Shoreline Treatment

## Volume I 1994 Biological Monitoring Survey

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## NOTICE

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# CHAPTER 1
# INTRODUCTION

## GENERAL

This document is the fifth annual progress report on studies designed to investigate the ecological implications of shoreline treatments on intertidal and shallow subtidal marine life of Prince William Sound, Alaska, following the March 1989 spill from the tank vessel *Exxon Valdez*. This program addresses two areas of great uncertainty and concern about the effect of oil on shorelines:

1. The length of time required for oil-damaged ecosystems to recover.

2. The effects of shoreline treatment methods on marine life and the extent to which treatment affects recovery.

It is imperative that information regarding shoreline recovery from the *Exxon Valdez* spill and the various treatments applied be made available to decision makers before the next such incident occurs. This need to obtain and disseminate information is the general rationale for the present study initiated by the National Oceanic and Atmospheric Administration (NOAA). Funding in 1994 was provided by NOAA and the Restitution Fund established as part of the settlement between the *Exxon Valdez* Oil Spill Trustees Council and Exxon.

Several studies conducted shortly after the spill demonstrated the effects of high-pressure hot-water treatment on shoreline marine life. Exxon-sponsored studies of the short-term effects of two different beach cleaning methods employed in 1989 (the July 1989 Omni-Barge test [Maki and Houghton 1989, Houghton et al. 1990a] and the Corexit 9580 test [Lees and Houghton 1990, Lees et al. 1993]) provide data that allow inference of the short-term effects of oiling and describe the short-term impact of hydraulic beach treatments. Both of these high-pressure hot-water washes clearly had significant, similar impacts on intertidal assemblages that had survived extended exposure to heavy oiling.

The 1990 NOAA biological studies in Prince William Sound (Houghton et al. 1991a, b) report conditions on rocky, boulder/cobble, and mixed-soft beaches and adjacent eelgrass beds in portions of the sound that were oiled, or oiled and high-pressure hot-water washed in 1989. Biological conditions on these beaches were compared to those on unoiled beaches of similar habitats. The conclusions were that 1) the effects of high-pressure hot-water washing remained evident in the biological assemblages 16 to 18 months after the spill, and 2) oiled beaches not treated in this manner were well on their way to recovery.

Results of the 1991 and 1992 NOAA biological studies in Prince William Sound (Houghton et al. 1993a, b) have shown that 1) infaunal and epibiotal assemblages not high-pressure hot-water washed resembled communities on beaches that were not oiled, in most respects, and 2) effects of high-pressure hot-water washing were still evident in some intertidal assemblages 40 months after the spill. Additional conclusions in 1991 were that oiling and subsequent treatment may have altered the spawning cycle of mussels and the reproductive strategy of eelgrass. Continued bioavailability of hydrocarbons was shown in the bioaccumulation of polycyclic aromatic hydrocarbons (PAHs) in transplanted mollusks. PAH levels in mussels had declined by an order of magnitude in 1991 from those seen in 1990, however, and generally continued to decline in 1992.

By 1993 (Houghton et al. 1994) most epibiota had recovered at all oiled sites; abundances in many cases were higher on oiled sites than on unoiled sites. This was attributed to continued instability in populations of biological control species. The infauna at hot-water washed lower intertidal stations continued to display lower density, richness, and diversity than those at reference stations and at oiled but unwashed stations. This continued difference raised a concern that the hot-water washed stations are fundamentally different from the other station categories and may never support similar infaunal communities.

Hydrocarbon data from sediments and tissues collected at stations sampled in this study in 1993 were reported by Henry et al. (1994), and results of histopathological analyses on mussel and clam tissues collected at our stations were reported by Brooks (1994). In companion studies to this one, Michel and Hayes (1990, 1991, and 1992) and Michel et al. (1991) documented the changes in beach profiles and hydrocarbon content at many of the sites sampled biologically in this program.

# SAMPLING OBJECTIVE AND APPROACH

## *Objectives*

The overall objectives of this study were:

- To assess and compare the impacts of oiling and shoreline treatment activities (specifically, effects of high-pressure hot-water washing) in important littoral (intertidal and shallow subtidal) habitats in the fifth year following the spill.
- To evaluate rates of recovery over several years in areas receiving differing levels of oiling and treatment.

For purposes of this study, "recovery" is defined as the return of the ecosystem to a state within the limits of natural variability (Ganning et al. 1984). Detailed information was obtained on the dynamics and ecological forces driving recovery at a relatively small number of carefully selected sites. Data reported herein were gathered in late June 1994, more than five years after the initial spill. It is anticipated that similar future studies will continue to document long-term recovery processes.

Funding levels in 1994 allowed only limited field sampling and limited interpretation of data generated. Specific tasks for 1994 included:

- Sampling epibiota at selected rocky intertidal stations.
- Collecting core samples for analysis of intertidal infaunal assemblage characteristics for comparisons with data from previous years.
- Continuing the photographic record at selected sites.
- Investigating factors influencing littleneck clam (*Protothaca staminea*) recruitment, growth, survival, and bioavailability of hydrocarbons through a coordinated series of transplanting and a settling experiment involving selected sediment treatments.

## *Approach and Field Work Accomplished*

The field approach in 1994 involved examining a limited spectrum of variables representative of the status of and trends in intertidal infaunal and epibiotal assemblages and species. The intent was to continue collection of data covering potential responses of a range of biological indicators to hydrocarbon contamination and to various disturbances caused by shoreline treatment. The data were used to compare the effects of hydrocarbon contamination and shoreline treatment and to compare rates and patterns of recovery in treated and untreated areas. The components examined in 1994 were:

- Quantitative studies of epibiota (those species living on the substratum surface): abundance and relative cover at selected rocky intertidal sites.

- Quality assurance/quality control (QA/QC) checks among quadrat enumerators to evaluate repeatability of visual enumerations.

- Quantitative studies of densities of macroinfauna at selected lower mixed-soft stations.

- Collecting littleneck (*Protothaca staminea*) and butter clams (*Saxidomus giganteus*) for use in growth and population studies at selected sites.

- Collecting samples for analyses of grain size, total organic carbon (TOC), total Kjeldahl nitrogen (TKN), and PAHs in surficial sediments and PAHs in Protothaca staminea and *Mytilus* cf. *trossulus*.

- Establishing clam transplant and recruitment experiments.

Intertidal sampling was conducted from June 19 to June 29, 1994, with two vessels and crews. About 80 person-days were expended collecting 213 samples of all types. Additional samples for mussel- and clam-tissue hydrocarbon analyses were collected July 20 to July 26, 1994.

Epibiotic quadrats were examined at 37 rocky stations (Table 1-1) and at the Northwest Bay West Arm mixed-soft site. A rapid survey for community dominants was conducted at the boulder/cobble beach of the Omni-Barge test site. QA/QC checks of quadrat enumerators were conducted at Block Island and Eshamy Bay middle rocky stations. At 12 lower intertidal mixed-soft stations, 7 sediment cores were collected; 5 were used for infaunal analyses and 2 were analyzed for grain size distribution and TOC/TKN. At a highly contaminated lower mixed-soft site, 11 sediment PAH samples were collected. Mussel-tissue samples were collected at 16 stations for tissue hydrocarbon analyses. Littleneck clam samples were collected at 10 lower stations for age and population studies. Clam-tissue samples were collected at seven stations for tissue hydrocarbon analyses.

**Table 1-1 Intertidal rocky stations sampled in 1989-94 by oiling/treatment category. ***

| Elevation | Category/Station | Degree of oiling | Apr-89 | May-89 | Jul-89 | Sep-89 | Jul-90 | Sep-90 | May-91 | Jul-91 | Sep-91 | Jul-92 | Jul-93 | Jun-94 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Upper | Category 1 | | | | | | | | | | | | | |
| | Bass Harbor | None | | | | x | x | | x | x | | x | | x |
| | Eshamy Bay | None | | | | x | x | x | | x | | x | x | x |
| | Hogg Bay | None | | | | x | x | x | x | x | | x | | x |
| | Category 2 | | | | | | | | | | | | | |
| | Herring Bay | Heavy | | | | x | x | x | x | x | | x | x | x |
| | Outside Bay | Light | | | | x | x | x | x | x | | x | x | x |
| | Snug Harbor | Heavy | | | | x | x | x | x | x | | x | x | x |
| | Category 3 | | | | | | | | | | | | | |
| | Mussel Beach South | Heavy | | | | x | x | x | x | x | | x | x | x |
| | NW Bay Islet | Heavy | | | | x | x | x | x | x | | x | | x |
| | Block Island | Heavy | | | | | | | x | x | | x | x | x |
| | Elrington East | Heavy | | | | | | | | | | x | | |
| | Mussel Beach North | Heavy | | | | | | | | | | x | x | x |
| | Elrington Islet - North | Heavy | | | | | | | | | | x | | x |
| | Elrington Islet - West | Heavy | | | | | | | | | | x | | x |
| | Elrington Islet - East | Heavy | | | | | | | | | | x | | x |
| Middle | Category 1 | | | | | | | | | | | | | |
| | Crab Bay | None | x | | x | x | x | x | x | x | | x | x | x |
| | Eshamy Bay | None | x | x | x | x | x | x | | x | | x | x | x |
| | Hogg Bay | None | x | | x | x | x | x | x | x | | x | | x |
| | Category 2 | | | | | | | | | | | | | |
| | Herring Bay | Heavy | x | x | x | x | x | x | x | x | | x | x | x |
| | Outside Bay | Light | x | | x | x | x | x | x | x | | x | x | x |
| | Snug Harbor | Heavy | | x | x | x | x | x | x | x | | x | | x |
| | Bay of Isles | Light | x | | x | x | x | x | | x | | | | |
| | Northwest Bay W. Arm ** | Moderate | | | | x | | | | x | | x | x | x |
| | Category 3 | | | | | | | | | | | | | |
| | Block Island | Heavy | | | | | x | x | x | x | | x | x | x |
| | NW Bay Islet | Heavy | x | x | x | x | x | x | x | x | | x | x | x |
| | NW Bay West Arm | Moderate | | | | x | x | | | x | | x | x | x |
| | Elrington East | Heavy | | | | x | | | | | | x | | x |
| | Elrington West | Heavy | | | | x | | | | | | x | | x |
| | Mussel Beach North | Heavy | | | | | | | | | | x | x | x |
| Lower | Category 1 | | | | | | | | | | | | | |
| | Crab Bay | None | x | | x | | x | x | | x | | x | x | x |
| | Hogg Bay | None | x | | x | | x | x | | x | | x | | x |
| | Eshamy Bay | None | x | x | x | | | x | | | x | x | x | x |
| | Category 2 | | | | | | | | | | | | | |
| | Snug Harbor | Light | | x | x | | x | x | | x | | x | x | x |
| | Outside Bay | Light | x | | x | | x | x | x | x | | x | x | x |
| | Category 3 | | | | | | | | | | | | | |
| | Northwest Bay Islet | Heavy | | x | x | x | x | x | x | x | | x | x | x |
| | Elrington East | Moderate | | | | | | | | | | x | | x |
| | Elrington West | Moderate | | | | | | | | | | x | | x |
| | Mussel Beach North | Moderate | | | | | | | | | | x | x | x |

* Category 1 = Unoiled; Category 2 = Oiled, untreated; Category 3 = Oiled, treated with hot water. Note: Stations categorized as oiled and treated are known to have been treated with some form of hot-water washing.

** There is uncertainty regarding treatment history at this site; thus it was not included in any category analyses.

Specimens of individually tagged *Nucella*, originally released in 1991, were collected and measured on an as-time-allowed basis. Tagged *Nucella* were recovered at Bass Harbor, Outside Bay, Crab Bay, and Eshamy Bay.

In accordance with the Scope of Work specified by Amendment 11 of the contract, two experiments were established to investigate factors affecting recovery of hard-shell clam populations.

The first experiment involved cross transplants of marked clams between Block Island and Outside Bay. Clams will be recovered in 1995 for examination of survival, growth, and uptake/depuration of PAHs.

The second experiment was designed to investigate sediment factors that may be affecting recruitment of clams on the oiled and hot-water washed Northwest Bay West Arm mixed-soft site. Pots containing local sediments, Northwest Bay sediments, and Northwest Bay sediments supplemented with organically rich sediments were placed at the lower stations in Northwest Bay, Block Island, and Outside Bay. Cores to be recovered in 1995 will be examined for colonization by young-of-the-year clams.

### *Hypotheses Tested*

Three treatment categories were defined at the beginning of the 1990 study: Category 1 (unoiled), Category 2 (oiled but untreated or moderately treated), and Category 3 (treated with high-pressure hot-water wash). Within each of these treatment categories, multiple sites were sampled in each year to provide replication for statistical testing. Based upon the stated study objectives, several null hypotheses previously formulated were tested to evaluate the continued effects of oiling and shoreline treatment on the intertidal assemblages in selected habitats:

1a. Relative cover of dominant algal taxa does not differ among site categories.

1b. Abundance (density or percent cover) of dominant epifaunal species does not differ among site categories.

2. Total abundance, number of taxa, and diversity of infaunal taxa in lower mixed-soft substrata do not differ among site categories.

3. There is no difference in the nature of (trends in) recovery between site categories 2 and 3.

# SAMPLING DESIGN

A stratified random sampling design was used in all years to assess important intertidal assemblage and population (individual taxa) characteristics. Sampling was structured following Zeh et al. (1981) to obtain statistically reliable estimates of density or cover of macrobiota inhabiting the surface (epibiota) and, where possible, the subsurface (infauna) within important life zones and within typical habitats.

The intertidal sampling effort was initially stratified according to three habitat types important in Prince William Sound:

- Sheltered rocky habitats—Intertidal substratum composed primarily of bedrock or very large boulders (50 centimeters (cm) or larger).

- Boulder/cobble habitats—Exposed beaches with nearly 100 percent cover by rounded cobbles and boulders ranging from about 10 to 50 cm. Some larger materials and/or bedrock outcroppings were occasionally present.

- Mixed-soft habitats—Typically a mixture of silt, granules, and pebbles with varying amounts of cobbles (5 to 25 cm) or boulders (25 to 50 cm).

Sheltered (low energy) rocky and mixed-soft sites were initially included for two reasons: their biological productivity was high, and their low-energy regime reduces the rate of natural weathering of oil (Jahns et al. 1991, Michel et al. 1991). In 1994, sampling was conducted at 18 rocky sites (Table 1-1) and 12 mixed-soft sites (Table 1-2). Exposed boulder/cobble sites were sampled in earlier years because they represented some of the most heavily oiled beaches in the sound: oil often penetrated deeply into the open spaces between the coarse materials. A rapid survey for community dominants was conducted at a single boulder/cobble site.

To represent important life zones (i.e., to further stratify the sampling), three elevations (stations) were typically sampled for epibiota at each site:

- near the upper limit of attached macrobiota,

- near the upper portion of the broad rockweed-dominated zone, and

- along the lower edge of this rockweed zone.

**Table 1-2 Intertidal infauna stations sampled in 1989-94 by oiling/treatment category. ***

| Elevation | Category/Station | Apr-89 | May-89 | Jul-89 | Sep-89 | Jul-90 | Sep-90 | May-91 | Jul-91 | Sep-91 | Jul-92 | Jul-93 | Jun-94 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Upper | **Category 3** | | | | | | | | | | | | |
| | Sleepy Bay | | | | | x | x | | | | | | |
| Middle | **Category 1** | | | | | | | | | | | | |
| | Crab Bay | | | | | x | x | | x | | x | | |
| | Sheep Bay | | | | x | x | x | | x | | x | | |
| | Outside Bay | x | | | x | x | x | | x | | x | | |
| | **Category 2** | | | | | | | | | | | | |
| | Snug Harbor | | | | | x | x | | x | | x | | |
| | Mussel Beach South | | | | | | x | | x | | x | | |
| | Crafton Island | | | | | | | | x | | | | |
| | **Category 3** | | | | | | | | | | | | |
| | NW Bay W. Arm | | | | | | x | | x | | x | | |
| | Shelter Bay | | | | x | x | x | | x | | x | | |
| | Sleepy Bay | | | | | x | x | | x | | x | | |
| | Block Island | | | | | | x | | | | x | | |
| Lower | **Category 1** | | | | | | | | | | | | |
| | Crab Bay | | | | | x | x | | | | x | x | x |
| | Sheep Bay | | | x | | x | x | | x | | x | x | x |
| | Outside Bay | x | | x | | x | x | x | x | | x | x | x |
| | Bainbridge Bight | | | | | | | x | x | x | x | x | x |
| | **Category 2** | | | | | | | | | | | | |
| | Herring Bay | x | x | x | x | x | x | x | x | | x | x | x |
| | Bay of Isles | x | | x | x | | x | | x | | | | |
| | Snug Harbor | | x | x | x | x | x | x | x | | x | x | x |
| | Block Island | | | | | x | x | x | x | | x | x | x |
| | Mussel Beach South | | x | x | x | x | | | x | | x | x | x |
| | Ingot Island | | | | | | x | | x | | x | x | |
| | Crafton Island | | | | | x | x | | x | | | x | |
| | **Category 3** | | | | | | | | | | | | |
| | NW Bay W. Arm | | x | x | | x | x | x | x | | x | x | x |
| | Shelter Bay | | x | x | x | x | x | x | x | | x | x | x |
| | Sleepy Bay | | | | | | | | x | | x | x | x |
| | Elrington West | | | | | | | | | | x | x | x |

* Category 1 = Unoiled; Category 2 = Oiled, untreated; Category 3 = Oiled, treated with hot water. Note: Stations categorized as oiled and treated are known to have been treated with some form of hot-water washing.

Thus, in the terminology of this study, a "location" such as Snug Harbor, can have both rocky and mixed-soft "sites," and each site can have up to three "stations" to represent different intertidal zones (Figure 1-1). Infauna was typically sampled only at lower elevation stations at mixed-soft sites. At each station sampling was conducted at points along a transect line laid parallel to the waterline along the beach contour. Detailed descriptions and discussion of the sample design employed have been provided in the 1991 and 1992 reports (Houghton et al. 1993a, b).

## SITE CLASSIFICATION, OILING, AND TREATMENT HISTORY

About 570 kilometers (km) of shoreline in Prince William Sound received sufficient oiling to require some form of shoreline cleanup or treatment in 1989 (Harrison 1991). Intensive efforts were made to verify the treatment history for each of the sites in this study (see Appendix Table A-1 in Houghton et al. 1993a). Information used to document the site designations was compiled from Exxon and State of Alaska records of treatments applied to various "beach segments" and from conversations with knowledgeable personnel in the field during 1989 (e.g., the authors, NOAA personnel, and field bosses for specific locations). Each site sampled in the present study typically occupied only about 50 meters (m) along a given beach and thus represents only a small fraction of the shoreline segment in question as these segments could range from a few hundred meters to several kilometers long.

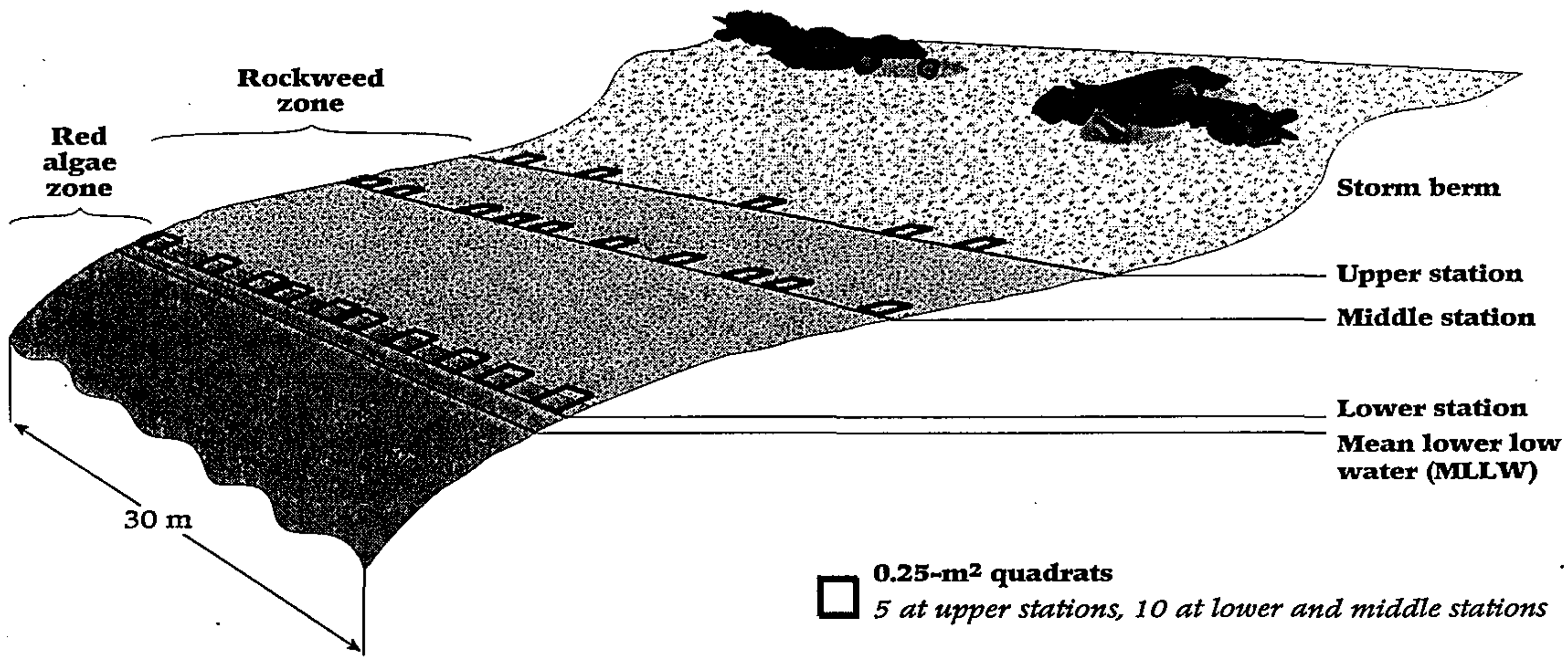



Figure 1-1. Typical site layout.

For statistical testing and qualitative discussion purposes, sites or stations within each habitat type were assigned to one of three categories to represent the range of possible stresses experienced in 1989. Stations at a given site may or may not be classified in the same category, depending on the site's known treatment history. Stations were classified as Category 1, 2, or 3 based on available information regarding habitat disturbance from oiling and high-pressure hot-water treatment. Replicate stations were assigned to the following three site categories:

- Category 1: Unoiled in 1989—No significant oiling or treatment reported; considered reference stations.
- Category 2: Oiled in 1989—Untreated (set aside) or treated with cool-water flushes in 1989 and/or bioremediation in 1989, 1990, or 1991.
- Category 3: Oiled in 1989—Treated with high-pressure hot-water wash(es); most, if not all, were also bioremediated in 1989, 1990, and/or 1991.

Some sites or stations (Northwest Bay Islet and West Arm mixed-soft) were sampled in 1989 before and after treatment and thus effectively moved from Category 2 to Category 3. These instances are noted in the appropriate data presentations.

Each intertidal station was classified as to the degree of oiling experienced in 1989. Because oiling was typically very uneven vertically over the intertidal zone, and upper elevations were much more heavily oiled, there is little point in mandating the same oiling classification for all stations (elevations) at a site. Moreover, the width of the oiled band on a shoreline has little effect on the specific intertidal assemblage at a station; what is important is the specific degree of oiling to which the plants and animals at that station were actually exposed (cf. Page et al. 1993).

The following oiling classifications were used in this study:

- **Unoiled**—No area of continuous oiling present at any time in 1989. Some sheens may have been present on adjacent waters. In 1990 no oiling was present except for possible widely scattered tarballs or spots of indeterminate origin.

- **Lightly oiled**—Patches of oiling in 1989 with fresh oil, mousse, or tar; cover generally less than 50 percent, or large areas of continuous sheen present on the beach. Little if any oil was visible in 1990. All stations at a site reported to have been oiled were considered to have been at least lightly oiled, even if no evidence of oil was ever gathered from that elevation.

- **Moderately oiled**—Near-continuous oiling in 1989 with fresh oil, mousse, or tar; cover often exceeded 50 percent and approached 100 percent in some areas with relatively thin sheens; few areas of thick deposition (i.e., several millimeters or more). Usually some oil remained in these areas in 1990 in the form of dry tar crusts on upper rock surfaces or light sheens within soft sediments.

- **Heavily oiled**—Continuous oiling in 1989 with fresh oil, mousse, or tar; cover approaching or reaching 100 percent; some thick deposits (i.e., several millimeters or more). Considerable oil generally remained in these areas in 1990 in the form of dry tar crusts on upper rocks or sheens and moist tar spots within soft sediments.

## THE STUDY AREA

Prince William Sound is a protected fjord and estuary system located on the south-central coast of Alaska (Figure 1-2). Wave action from northern Pacific storms is blocked by the outer line of islands. The winds, however, are only minimally abated by the low-lying peaks of those islands. This topography generates storm seas and chop that strike exposed shorelines with high intensity wave action during storm events. Within embayments, wave energy may be minimal despite high wind forces because of limited fetch and frequent shifts in wind direction (Bascom 1964; Lethcoe and Lethcoe 1989). Fetch at specific locations within Prince William Sound, including several sites in this study, is provided by Michel and Hayes (1991). Tides are of the mixed semi-diurnal type; mean tide level is about 1.8 m, and extreme range is more than 5 m.

The study area encompassed most of central and southern Prince William Sound from Sheep Bay on the eastern mainland to Eshamy Bay and Bainbridge Passage on the western mainland (Figure 1-2). The sampling focused on the chain of islands stretching from Naked Island (in the central sound), south-southwest through the Knight Island group, to the islands protecting the southwest entrances to the sound. This portion of the sound lay in the path of oil from the *Exxon Valdez* and many beaches on these islands were oiled.

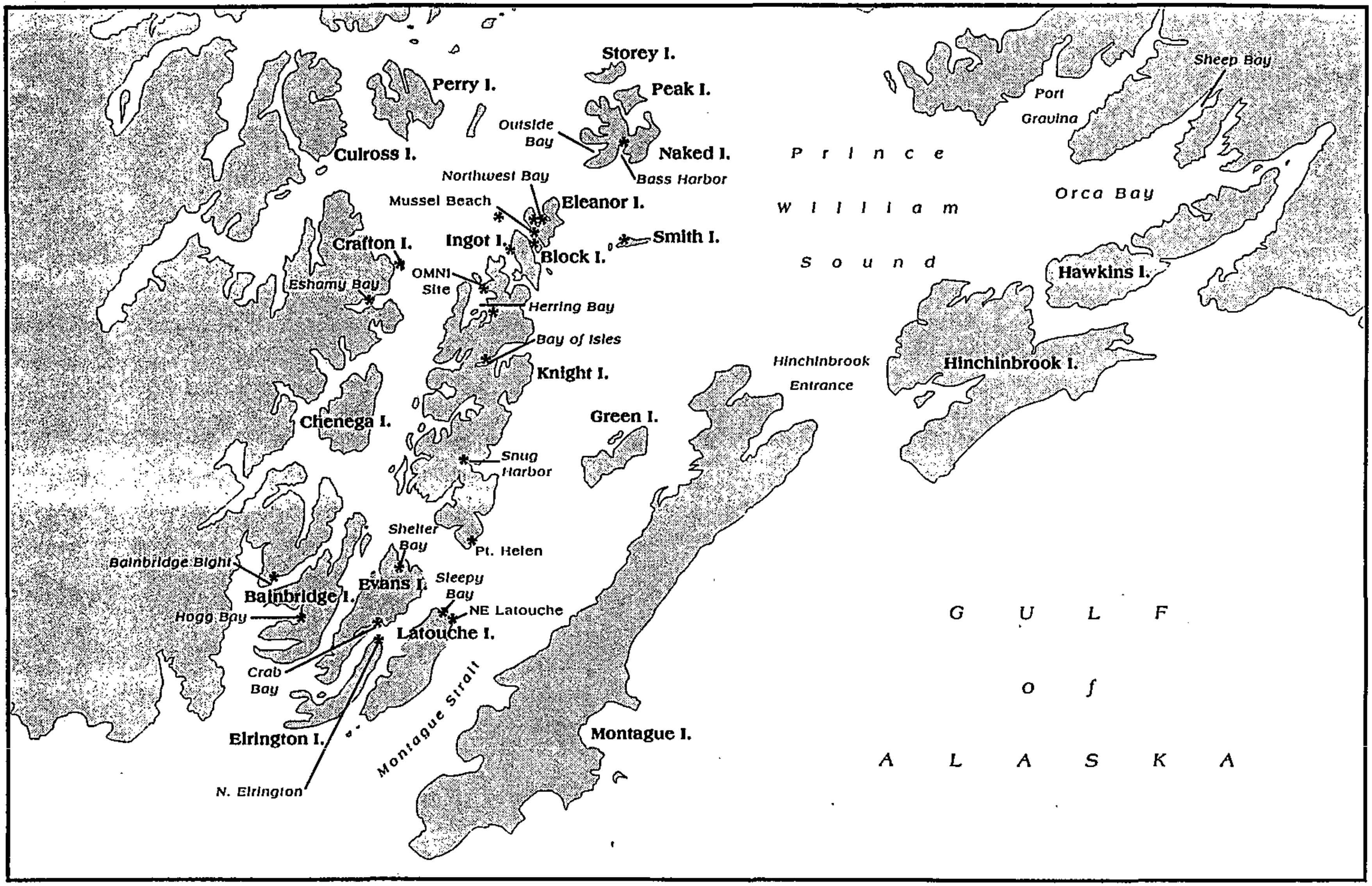



Figure 1-2. Prince William Sound study area and sampling locations (asterisks).

Unoiled beaches in Prince William Sound support biological communities relatively specific to and characteristic of a given habitat type and range of tidal elevation. Within these communities there are usually several species that, because of their abundance and/or ecological roles (e.g., as an effective grazer or predator), exert a strong influence on other kinds of organisms found in the community. Throughout this report these taxa are termed community or assemblage "dominants."

## REPORT ORGANIZATION

The 1994 report is organized into several chapters, each of which reports on methods used and results of specific aspects of the study. Because this is considered a data report rather than an interpretive report, emphasis is placed on tabular and graphical data presentations and narrative discussion of the data is limited. Chapter 2 is a report on intertidal epibiota and associated physical and water quality measurements. Chapter 3 is a report on intertidal infaunal communities and sediment grain size and chemical analyses. Chapter 4 contains results of mollusk studies. Chapter 5 briefly discusses major findings and conclusions. Chapter 6 provides references for literature cited and acronyms used in this report.

# CHAPTER 2
# INTERTIDAL EPIBIOTA

## INTRODUCTION

Intertidal epibiota (the assemblage of plants and animals living on or attached to the substratum) was sampled in late June 1994 at one or more elevations at 18 rocky sites and at the lower and middle elevations at the Northwest Bay West Arm mixed-soft site. A rapid survey of community dominants was conducted at the boulder/cobble beach of the Omni-Barge test site. A summary of selected 1989-94 intertidal sampling tasks and months of collection is shown in Appendix Table A-1. Only sampling tasks included in 1994 are shown; tasks completed in other years are shown in Appendix Table A-1 in Houghton et al. (1993b). Latitude and longitude coordinates from a global positioning system (GPS) for each of the study sites are found in Appendix Table A-2 in Houghton et al. (1993b). Tidal elevations of stations at each study site are located in Appendix Table A-3 in Houghton et al. (1993b).

Field sampling of epibiota was conducted by intertidal ecologists with many years of experience in the taxonomy and natural history of Alaskan intertidal organisms. Some qualitative observations of trends or patterns observed in the course of field surveys are reported on the basis of this experience without quantitative measurements or without demonstration of statistical significance.

## METHODS

### *Field*

#### Water Quality

Water temperature and salinity were measured with a YSI 33 meter at ten locations visited in June 1994 (Appendix Table A-2). The probe was gently lowered to about 0.3 m, and at some sites to 1.8 or 2.4 m, below the surface of the water. Water temperature (±0.1°C) and salinity (parts per thousand [ppt]) were read directly off the meter.

## Epibiota

The abundance of epibiota was measured in June 1994 at one, two, or three elevations on rocky substrata (Table 1-1) and at two elevations at the single mixed-soft site. Five or ten 0.25-$m^2$ quadrats were sampled on 30-m sampling lines (transects) oriented along the beach contour. Quadrats were repositioned at the same orientation as those previously sampled with the aid of previously placed rebar stakes, spikes, or epoxy markers. Where possible, the position of a quadrat was adjusted by referring to photographs taken during previous surveys.

Prior to sampling, each quadrat was photographed with a label showing the site, date, and quadrat number. Most taxa were identified by biologists in the field. Problematic taxa were collected (from outside the sample area, if possible) for cross-comparison among investigators or identification onboard the support vessel or in the laboratory. Biological variables measured or estimated included algal cover (percent by taxon) and numbers or percent cover of major epibenthic fauna. Relative cover estimates for biota, substratum type, and oiling were based on visual examination of the tops, sides, and overhangs within a quadrat, but rocks fist size and larger were not overturned. Whenever any oil was found, a subjective description of oiling in each quadrat was recorded along with the percentage of oil cover found within the quadrat.

## Field QA/QC

All members of the field sampling team discussed procedures for field sampling at a mobilization meeting aboard each vessel before sampling to ensure that everyone understood the field methods to be used and that methods were followed consistently. This common understanding and using the same personnel as in the prior studies, maximized consistency with procedures used in previous years.

Several checks were made prior to any data collection in the field. Quadrats sampled at each location were checked against a master list of stations, dates of previous sampling, and quadrats that had previously been sampled destructively and nondestructively since 1989. This check precluded resampling an area previously sampled destructively. Notes on the orientation of the station line and any deviations in the previous samplings were also checked.

Some of the header information required on the data sheets (including location, elevation, date, foot marker numbers of quadrats to be sampled, and sample identification [ID]) was completed onboard the support vessel before sampling. The sample ID numbers consisted of an eight-digit designation composed of the year, month, day, and a unique sample serial number. The principal investigator checked these numbers against the computer logs to ensure that numbers were not duplicated. Members of the field team noted these numbers, along with the type of sample to which each was assigned, in their field notebooks for reference in the field. Filling out the computer sample ID log before sampling ensured that all desired sampling activities were accomplished at each location.

On the beach, data sheets were checked to be sure header information was correct. The time sampling began was entered, and the data recorder checked quadrat numbers against the master station list to be sure that the quadrat numbers sampled were correct for the elevation. One person laid the tape in the appropriate direction from the station origin stake and checked with the recorder to see if permanent quadrat locations lined up with markers. Deviations from previous samplings were noted on the data sheet. The initials of the recorder were placed at the top of the data sheet and the initials of the quadrat enumerator were placed at the top of each data column.

There was frequent cross-checking of taxonomic identifications and estimates of percent cover between quadrat enumerators. At two stations (Block Island middle and Eshamy Bay middle), two or more observers independently enumerated several quadrats (Appendix Table B-1-1).

Invertebrate nomenclature generally followed Kozloff (1987), and algal nomenclature followed Gabrielson et al. (1989). Problematic species and unique fauna and flora were placed in plastic bags, labeled, and returned to the support vessel for identification or preservation as reference or voucher specimens. When sampling was finished, the recorder checked to make sure that all header information was entered on the data sheet, and another person checked that all information was complete. A final review of the data sheets was made onboard the support vessel and included checking the sample ID numbers against those previously assigned.

## *Statistical Analyses*

### Inferential Statistics

Various statistical analyses were applied to quantitatively describe the data (number of species, number of individuals, and percent cover by species) and evaluate the significance of the findings. Parametric and nonparametric tests were applied as appropriate to evaluate the significance of differences observed between station categories. In these tests the mean of all subsamples (replicates) at a given station was used to represent each variable; thus, n = the number of stations within that category where the variable in question was measured.

For tests of category effects and site-to-site differences in intertidal epibiota and environmental variables, a critical value (alpha) of p = 0.1 was used. Eberhardt and Thomas (1991) note that the alpha of 0.05 "automatically" selected by most ecologists may be inappropriate in some cases. Use of 0.1 allows that there is a 1-in-10 chance of falsely rejecting the null hypothesis ("no difference between site categories"—Type I error). If there is a greater concern for falsely accepting a null hypothesis that is in fact false (i.e., failure to identify significant effects of oiling or treatment when they exist—Type II error), then a lower critical value may be justified.

Eberhardt and Thomas (1991) note further that a disparity commonly occurs about probability values between analysts on opposing sides of a controversial environmental issue. Those wishing to show "no effect" may ignore Type II error and opt for a critical p value of 0.05 or even 0.01; those concerned with not missing an impact can choose a higher probability value to reduce the Type II error. Therefore, the authors have considered probability levels of 0.1 or less to represent significant differences (i.e., to reject the null hypothesis) in most aspects of this study. Use of the randomization approach to analysis of variance (ANOVA) and t-testing allows computation of exact p values.

Many trends are noted as differences in mean values where no probability value is given. These differences are considered biologically relevant even though they are not statistically significant, often because of the limited replication of stations within site categories. Differences described between site categories also have been tested between pairs of stations representing those categories, often with significant results because of the greater sample size available.

## Randomization Tests

Enumeration data were first tested for significant category effects (see null hypotheses in Chapter 1) using a randomization ANOVA and then tested for significant differences between pairs of site categories with a 2-tailed randomization t-test (Edgington 1987). Randomization tests are distribution-free statistical tests in which the data are repeatedly reassigned among and between treatment groups. First, a test statistic (e.g., t or F statistic) is computed for the initial data set. The data set is then randomly shuffled and the test statistic recalculated. Following a thousand or more passes of this iterative process, the proportion of random test statistics greater than or equal to the initial test value represents the exact significance of the results. All assumptions of normality, homogeneity of variance, and other characteristics of randomly sampled populations are not relevant, with one exception: that the data set truly represents the population of interest (i.e., is sampled randomly, Edgington 1987).

Randomization ANOVA tests performed on epibiota (middle rocky stations) data collected in 1990 indicated that, for certain dominant taxa, there were significant category effects—that is, abundance varied significantly among treatment categories. Multiple comparison tests using the 1990 data (Houghton et al. 1991a) identified significant ($p < 0.1$) differences in abundances of certain taxa between various permutation pairs of site categories. The same approach, ANOVA for category effects followed by t-tests for significance of differences between pairs of site categories, was applied in 1991 through 1994. Because a main purpose of this study is to assess the degree of recovery occurring over time, it was considered important to continue to test for differences between pairs of site categories, even for taxa for which no experiment-wise category effect remained in 1991 through 1994. It is recognized that such multiple comparisons have a statistical penalty in the true experiment-wise alpha (Type I error term): differences calculated to have an alpha of 0.1 in the multiple comparison randomization t-tests in fact represent differences that have a greater than 1-in-10 chance of occurring randomly.

For epibiota, detailed abundance data (Appendix B) were used in calculations of total algal cover and total taxa present. Certain taxa were subsequently combined into higher taxonomic groups (e.g., all species of limpets into the Family Lottiidae) for ease of presentation (e.g., Tables 2-1 through 2-8) and for statistical testing. A randomization ANOVA was used to determine if a significant category effect existed and was followed by randomization t-tests for differences among station categories for dominant taxonomic groups.

## RESULTS AND DISCUSSION

### *Physical Measurements*

Water temperature and salinity were measured at ten locations. Lowest surface water temperature (7.2°C) and highest salinity (29.5 ppt) were recorded at Bainbridge Bight. Highest surface water temperature (13.2°C) was recorded at Snug Harbor. Lowest salinity (24.2 ppt) was measured at Eshamy Bay (Appendix Table A-2). Oil cover remained at or near zero at all stations at all elevations in 1994.

**Table 2-1.** **Mean abundance (% or no./0.25 m²) of important epibiota at upper rocky stations, June 1994 (*P ≤ 0.10).**

| | Category 1 | | Category 2 | | Category 3 | | |
|---|---|---|---|---|---|---|---|
| **Lumped taxon** | **Mean** | **SD** | **Mean** | **SD** | **Mean** | **SD** | **ANOVA** |
| **Plants (% cover)** | | | | | | | |
| Encrusting brown algae | 0.00 | 0.00 | 0.00 | 0.00 | 1.30 | 1.47 | |
| Encrusting red algae | 0.80 | 0.60 | 1.97 | 2.98 | 1.47 | 1.93 | |
| Endocladiaceae | 1.17 | 1.93 | 2.20 | 3.55 | 0.03 | 0.06 | |
| *Fucus gardneri* | 0.27 | 0.46 | 12.20 | 20.27 | 6.87 | 11.63 | |
| *Fucus gardneri* (germlings) | 0.33 | 0.12 | 0.60 | 0.53 | 0.20 | 0.17 | |
| Misc. Chlorophyta | 0.47 | 0.47 | 0.53 | 0.61 | 0.13 | 0.23 | |
| Rhodomelaceae/*Cryptosiphonia* | 0.13 | 0.23 | 0.00 | 0.00 | 0.03 | 0.06 | |
| *Verrucaria* spp. | 34.37 | 50.22 | 11.20 | 9.42 | 8.10 | 10.72 | |
| **Total plant cover (%)** | **37.57** | | **28.73** | | **18.27** | | |
| **Number of plant taxa*** | **5.33** | | **5.33** | | **6.33** | | |
| | | | | | | | |
| **Animals (% cover or no./0.25 m²)** | | | | | | | |
| *Balanus glandula* | 0.77 | 0.40 | 0.83 | 0.68 | 0.40 | 0.10 | |
| *Balanus/Semibalanus* spp. (set) | 4.20 | 7.01 | 0.50 | 0.50 | 0.10 | 0.10 | |
| *Chthamalus dalli* | 2.63 | 4.13 | 0.97 | 1.24 | 0.33 | 0.25 | |
| Mytilidae (spat) | 0.23 | 0.40 | 0.03 | 0.06 | 0.00 | 0.00 | |
| *Mytilus* cf. *trossulus* | 0.10 | 0.17 | 0.13 | 0.23 | 0.17 | 0.15 | |
| *Semibalanus balanoides* | 9.47 | 16.40 | 0.93 | 0.81 | 0.57 | 0.90 | |
| *Littorina scutulata* | 76.27 | 95.55 | 81.07 | 55.30 | 50.27 | 54.52 | |
| *Littorina sitkana* | 41.07 | 39.14 | 68.87 | 73.37 | 53.47 | 28.96 | |
| Lottiidae | 1.27 | 1.33 | 13.47 | 14.03 | 6.00 | 6.58 | |
| Lottiidae (juvenile) | 10.87 | 18.82 | 0.27 | 0.46 | 0.80 | 1.39 | |
| *Nucella lamellosa* | 3.07 | 5.31 | 0.07 | 0.12 | 0.00 | 0.00 | |
| *Pagurus hirsutiusculus* | 0.00 | 0.00 | 0.13 | 0.23 | 0.93 | 1.62 | |
| **Number of animal taxa*** | **10.67** | | **9.33** | | **8.33** | | |
| | | | | | | | |
| **Dead organisms (% cover or no./0.25 m²)** | | | | | | | |
| *Balanus glandula* | 0.33 | 0.06 | 0.20 | 0.20 | 0.20 | 0.20 | |
| *Chthamalus dalli* | 0.20 | 0.17 | 0.10 | 0.10 | 0.00 | 0.00 | |
| *Mytilus* sp. | 0.33 | 0.31 | 0.13 | 0.23 | 0.00 | 0.00 | * |
| *Semibalanus Balanoides* | 0.63 | 1.10 | 0.03 | 0.06 | 0.03 | 0.06 | |
| | | | | | | | |
| **Other (% cover)** | | | | | | | |
| Boulder/cobble | 33.20 | 57.50 | 33.80 | 55.12 | 19.53 | 33.66 | |
| Gravel/sand | 0.13 | 0.23 | 0.87 | 1.50 | 0.53 | 0.92 | |
| Oil cover | 0.00 | 0.00 | 0.17 | 0.29 | 0.03 | 0.06 | |
| Oil scale | 0.00 | 0.00 | 0.80 | 1.39 | 0.30 | 0.44 | |
| Rock | 66.67 | 57.74 | 65.33 | 56.62 | 79.93 | 34.58 | |
| | | | | | | | |
| **Number of stations** | **3** | | **3** | | **3** | | |

*Number of taxa appearing at a site based on detailed taxonomic data in Appendix C.

Table 2-2. Mean abundance (% or no./0.25m2) of important epibiota at three upper rocky intertidal transects at Elrington Islet, June 1994 (*$p \leq 0.10$; **$p \leq 0.05$; ***$p \leq 0.01$).

| | Elrington East Islet | | | Elrington North Islet | | | Elrington West Islet | | | | t-tests | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lumped Taxon | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count | ANOVA | E vs. N | E vs. W | N vs. W |
| **Plants (% cover)** | | | | | | | | | | | | | |
| Encrusting red algae | 0.50 | 0.00 | 5 | 10.80 | 12.19 | 5 | 19.90 | 14.34 | 5 | ** | ** | *** | |
| *Fucus gardneri* | 0.00 | 0.00 | 5 | 5.10 | 6.99 | 5 | 5.20 | 8.52 | 5 | | * | ** | |
| *Fucus Gardneri* (germlings) | 0.30 | 0.27 | 5 | 0.30 | 0.27 | 5 | 0.50 | 0.50 | 5 | | | | |
| Misc. Chlorophyta | 1.80 | 2.93 | 5 | 4.90 | 5.92 | 5 | 0.40 | 0.22 | 5 | | | | ** |
| *Verrucaria* spp. | 0.20 | 0.45 | 5 | 19.00 | 21.33 | 5 | 0.50 | 0.87 | 5 | * | * | | * |
| **Total plant cover (5)** | **2.80** | | | **40.50** | | | **26.90** | | | *** | *** | *** | |
| **Number of plant taxa*** | **5** | | | **9** | | | **7** | | | | | | |
| **Animals (% cover or no./0.25 m$^2$)** | | | | | | | | | | | | | |
| *Balanus glandula* | 1.20 | 0.76 | 5 | 11.00 | 6.08 | 5 | 0.80 | 0.76 | 5 | *** | *** | | *** |
| *Balanus/Semibalanus* spp. (set) | 0.50 | 0.00 | 5 | 11.00 | 6.08 | 5 | 0.60 | 0.22 | 5 | *** | *** | | *** |
| *Chthamalus dalli* | 2.20 | 1.89 | 5 | 0.10 | 0.22 | 5 | 0.70 | 0.27 | 5 | *** | *** | ** | ** |
| *Mytilidae* (spat) | 0.40 | 0.42 | 5 | 1.10 | 2.19 | 5 | 0.40 | 0.22 | 5 | | | | |
| *Mytilus cf. trossulus* | 0.30 | 0.27 | 5 | 0.00 | 0.00 | 5 | 0.70 | 0.45 | 5 | ** | * | | ** |
| *Semibalanus balanoides* | 1.40 | 2.01 | 5 | 0.20 | 0.27 | 5 | 2.00 | 1.84 | 5 | | * | | ** |
| *Littorina scutulata* | 20.00 | 10.02 | 5 | 4.80 | 7.16 | 5 | 1.40 | 1.67 | 5 | *** | ** | *** | |
| *Littorina sitkana* | 2.00 | 3.39 | 5 | 1.00 | 1.73 | 5 | 8.20 | 16.71 | 5 | | | | |
| Lottiidae | 5.60 | 6.54 | 5 | 3.80 | 3.90 | 5 | 5.80 | 3.63 | 5 | | | | |
| **Number of animal taxa*** | **10** | | | **9** | | | **13** | | | *** | ** | | ** |
| **Dead organisms (% cover or no./0.25 m$^2$)** | | | | | | | | | | | | | |
| *Balanus glandula* | 0.20 | 0.27 | 5 | 0.70 | 0.27 | 5 | 0.40 | 0.22 | 5 | ** | ** | | |
| **Other (% cover)** | | | | | | | | | | | | | |
| Oil cover | 0.10 | 0.22 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | | | | |
| Oil scale | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | | | | |
| Rock | 100.00 | 0.00 | 5 | 100.00 | 0.00 | 5 | 100.00 | 0.00 | 5 | | | | * |
| Water | 1.20 | 2.68 | 5 | 0.00 | 0.00 | 5 | 1.30 | 1.72 | 5 | | | | |

*Number of taxa appearing at a site based on detailed taxonomic data in Appendix C.

Table 2-3. Mean abundance (% or no./0.25 m$^2$) of important epibiota at middle rocky stations, June 1994 (*$p \leq 0.10$; **$p \leq 0.05$; ***$p \leq 0.01$).

| | Category 1 | | Category 2 | | Category 3 | | | t-tests | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Lumped taxon** | **Mean** | **SD** | **Mean** | **SD** | **Mean** | **SD** | **ANOVA** | **1 vs 2** | **2 vs 3** | **2 vs 3** |
| **Plants (% cover)** | | | | | | | | | | |
| *Elachista* spp. | 2.43 | 4.21 | 0.05 | 0.05 | 0.33 | 0.58 | | | | |
| Encrusting red algae | 2.77 | 4.62 | 0.67 | 0.50 | 2.98 | 4.53 | | | | |
| Endociadiaceae | 0.85 | 0.30 | 1.18 | 1.35 | 0.47 | 0.15 | | | | |
| Filamentous brown algae | 1.02 | 0.81 | 3.37 | 4.31 | 0.22 | 0.20 | | | | |
| Filamentous green algae | 1.72 | 2.43 | 0.88 | 0.73 | 0.53 | 0.67 | | | | |
| Foliose green algae | 0.20 | 0.35 | 0.58 | 1.01 | 0.03 | 0.06 | | | | |
| *Fucus gardneri* | 49.63 | 24.66 | 50.47 | 17.21 | 39.65 | 12.98 | | | | |
| *Fucus gardneri* (germlings) | 1.13 | 0.39 | 0.68 | 0.46 | 0.73 | 0.56 | | | | |
| Gigartinaceae | 0.23 | 0.40 | 0.60 | 1.00 | 0.12 | 0.10 | | | | |
| *Halosaccion glandiforme* | 0.18 | 0.28 | 0.65 | 1.13 | 0.07 | 0.06 | | | | |
| Misc. Chlorophyta | 1.10 | 1.26 | 1.48 | 2.05 | 0.63 | 0.15 | | | | |
| *Palmaria* spp. | 0.55 | 0.95 | 0.00 | 0.00 | 0.00 | 0.00 | | | | |
| Rhodomelaceae/*Cryptosiphonia* | 1.43 | 1.58 | 0.70 | 0.77 | 3.65 | 3.63 | | | | |
| **Total plant cover (%)** | **63.83** | | **61.73** | | **50.50** | | | | | |
| **Number of plant taxa*** | **16.00** | | **14.33** | | **16.00** | | | | | |
| **Animals (%cover or no./0.25m$^2$)** | | | | | | | | | | |
| *Balanus glandula* | 3.02 | 3.48 | 0.45 | 0.61 | 2.72 | 2.03 | | | | |
| *Balanus/Semibalanus* spp. (set) | 11.42 | 15.91 | 4.72 | 6.75 | 0.58 | 0.30 | | | | |
| *Chthamalus dalli* | 4.47 | 5.34 | 7.52 | 12.03 | 4.18 | 6.34 | | | | |
| Mytilidae (spat) | 1.85 | 2.54 | 0.38 | 0.28 | 0.40 | 0.05 | | | | |
| *Mytilus* cf. *trossulus* | 6.10 | 4.88 | 3.77 | 3.29 | 6.27 | 5.89 | | | | |
| *Semibalanus balanoides* | 1.03 | 0.53 | 7.70 | 10.55 | 5.55 | 4.72 | | | | |
| *Semibalanus cariosus* | 5.73 | 9.93 | 0.10 | 0.17 | 0.00 | 0.00 | | | | |
| *Littorina scutulata* | 67.13 | 56.53 | 57.00 | 55.36 | 127.50 | 140.32 | | | | |
| *Littorina sitkana* | 47.17 | 64.47 | 57.37 | 64.69 | 23.60 | 18.65 | | | | |
| Lottiidae | 6.30 | 2.31 | 17.57 | 9.92 | 50.67 | 4.72 | *** | | * | ** |
| Lottiidae (juvenile) | 18.67 | 10.42 | 22.53 | 20.25 | 0.00 | 0.00 | | | * | |
| *Nucella lamellosa* | 10.53 | 7.89 | 1.43 | 2.48 | 1.27 | 2.19 | * | | * | |
| *Nucella lima* | 0.00 | 0.00 | 2.37 | 2.10 | 0.03 | 0.06 | | | | |
| *Onchidella borealis* | 0.93 | 1.62 | 0.07 | 0.06 | 0.00 | 0.00 | | | | |
| *Pagurus hirsutiusculus* | 10.77 | 5.00 | 5.70 | 5.05 | 24.23 | 17.92 | | | | |
| *Searlesia dira* | 0.00 | 0.00 | 0.03 | 0.06 | 0.57 | 0.98 | | | | |
| *Siphonaria thersites* | 6.93 | 10.49 | 5.20 | 9.01 | 3.63 | 5.70 | | | | |
| **Number of animal taxa*** | **18.67** | | **18.67** | | **20.67** | | | | | |
| **Dead organisms (% cover or no./925m$^2$)** | | | | | | | | | | |
| *Fucus gardneri* | 0.10 | 0.05 | 0.17 | 0.06 | 0.23 | 0.06 | ** | | * | |
| *Balanus glandula* | 0.53 | 0.33 | 0.17 | 0.29 | 0.72 | 0.68 | | | | |
| *Chthamalus dalli* | 0.48 | 0.43 | 0.37 | 0.55 | 0.43 | 0.66 | * | | * | |
| *Mytilus* sp. | 16.23 | 12.98 | 3.17 | 3.15 | 1.97 | 2.11 | * | | * | |
| *Semibalanus balanoides* | 0.08 | 0.14 | 0.42 | 0.28 | 0.52 | 0.52 | | | | |
| **Other (% cover)** | | | | | | | | | | |
| Boulder/cobble | 59.57 | 18.36 | 61.37 | 47.96 | 2.50 | 3.99 | | | * | |
| Gravel/sand | 7.10 | 5.72 | 1.80 | 2.31 | 0.13 | 0.23 | * | | ** | |
| Mud | 0.00 | 0.00 | 0.43 | 0.75 | 0.63 | 1.10 | | | * | * |
| Rock | 33.50 | 15.44 | 35.70 | 46.70 | 96.73 | 5.32 | | | * | * |
| **Number of stations** | **3** | | **3** | | **3** | | | | | |

* Number of taxa appearing at a site based on detailed taxonomic data in Appendix C.

Table 2-4. Mean abundance (% or no./0.25 $m^2$) of important epibiota at Northwest Bay West Arm middle rocky stations, September 1989 (n = 4,4), July 1991 (n = 5,5), July 1993 (n - 5,5), and June 1994 (n - 5,5) (*$p \leq 0.10$; **$p \leq 0.05$; ***$p \leq 0.01$).

| | 1989 | | | | 1991 | | | | 1992 | | | | 1993 | | | | 1994 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lumped taxon | Reference | Category 3 | Difference (%) | t-test | Reference | Category 3 | Difference (%) | t-test | Reference | Category 3 | difference (%) | t-test | Reference | Category 3 | Difference (%) | t-test | Reference | Category 3.0 | Difference (%) | t-test |
| **Plants (% cover)** | | | | | | | | | | | | | | | | | | | | |
| *Elachista fucicola* | a | a | b | | 3.8 | 0.1 | -97 | ** | 0.4 | 0 | -100 | | 0 | 0.2 | b | | 0.7 | 1.0 | 43 | |
| Encrusting coralline algae | 1.4 | 0 | -100 | | 4.6 | 0.2 | -96 | | 2.7 | 0.2 | -93 | | 1.3 | 1.0 | -23 | | 1.2 | 0.9 | -25 | |
| Encrusting non-coralline algae | 9.5 | 12.0 | 26 | | 16.0 | 9.4 | -48 | | 10.2 | 1.1 | -89 | ** | 14.1 | 7.5 | -47 | | 17.8 | 8.3 | -53 | |
| Filamentous Chlorophyta | 1.3 | 1.5 | 15 | | 1.2 | 2.0 | 67 | | 1.5 | 0.5 | -67 | | 6.6 | 0.9 | -86 | ** | 9.5 | 1.3 | -86 | ** |
| *Fucus gardneri* | 87.5 | 7.0 | -92 | ** | 88.0 | 34.4 | -61 | *** | 85.0 | 63.0 | -26 | | 74.0 | 65.4 | -12 | | 40.6 | 34.0 | -16 | |
| *Fucus gardneri* (germlings) | a | a | b | | 2.4 | 2.4 | 0 | | 0.8 | 0.2 | -75 | * | 1.8 | 0.4 | -78 | ** | 3.8 | 0.6 | -84 | |
| *Gloiopeltis furcata* | a | a | b | | 0.7 | 7.2 | 929 | ** | 2.5 | 4.6 | 84 | | 3.3 | 2.0 | -39 | | 2.2 | 0.3 | -86 | * |
| *Halosaccion glandiforme* | 0.4 | 0 | -100 | | 2.1 | 0 | -100 | ** | 1.0 | 0 | -100 | *** | 3.4 | 0 | -100 | ** | 4.2 | 0.1 | -98 | *** |
| *Mastocarpus papillatus* | 0.9 | 0.6 | -33 | | 1.4 | 0 | -100 | ** | 1.0 | 0 | -100 | | 0 | 0 | 0 | | 0.2 | 0 | -100 | |
| *Neorhodomela larix* | 6.3 | 0 | -100 | | 5.6 | 0.1 | -98 | | 6.1 | 0 | -100 | | 2.4 | 3.3 | 38 | | 2.0 | 1.0 | -50 | |
| *Neorhodomela oregona* | 8.3 | 4.0 | -52 | | 11.4 | 3.4 | -70 | * | 5.2 | 2.4 | -54 | | 5.6 | 2.2 | -61 | | 4.4 | 6.5 | 48 | |
| *Pilayella littoralis* | a | a | a | | 8.4 | 0.1 | -99 | ** | 1.4 | 0.8 | -43 | | 2.2 | 1.0 | -55 | | 6.6 | 0.4 | -94 | ** |
| **Total plant cover (%)** | 116.8 | 25.1 | -79 | ** | 149.40 | 61.8 | -59 | *** | 121.2 | 74.1 | -39 | *** | 124.0 | 88.4 | -29 | ** | 101.5 | 55.9 | -45 | ** |
| **Number of plant taxa** | 7.0 | 3.5 | -50 | * | 10.6 | 7.0 | -34 | | 12.2 | 4.8 | -61 | | 14.0 | 7.0 | -50 | ** | 15.2 | 8.2 | -46 | ** |
| **Animals (% cover or no./0.25 $m^2$)** | | | | | | | | | | | | | | | | | | | | |
| *Chthamalus dalli* (%) | 9.3 | 3.8 | -59 | | 23.6 | 15.5 | -34 | | 9.2 | 12.6 | 37 | | 12.9 | 15.0 | 16 | | 14.3 | 11.5 | -20 | |
| *Littorina scutulata* (#) | 0.3 | 12.3 | 4000 | ** | 10.2 | 312.8 | 2967 | ** | 12.2 | 433.6 | 3454 | *** | 2.0 | 16.2 | 710 | | 10.2 | 52.2 | 412 | |
| *Littorina sitkana* (#) | 1.8 | 1.8 | 0 | | 62.6 | 11.6 | -81 | * | 6.2 | 83.8 | 1252 | | 0.6 | 1.6 | 167 | | 19.2 | 2.4 | -88 | |
| Lottiidae (#) | 22.3 | 0.8 | -96 | ** | 47.0 | 22.4 | -52 | | 45.0 | 42.2 | -6 | | 60.4 | 31.8 | -47 | | 60.4 | 47.6 | -21 | |
| *Mytilus* cf. *trossulus* (%) | 0 | 0.1 | b | | 0.4 | 0.5 | 25 | | 2.5 | 0.9 | -64 | | 0 | 0.1 | b | | 0.1 | 0 | -100 | |
| *Nucella lamellosa* (#) | 10.8 | 3.3 | -69 | | 7.0 | 0.6 | -91 | *** | 7.2 | 14.6 | 103 | | 10.4 | 10.2 | -2 | | 8.4 | 3.8 | -55 | |
| *Pagurus hirsutiusculus* (#) | 3.0 | 5.0 | 67 | | 11.2 | 1.8 | -84 | ** | 7.8 | 2.8 | -64 | * | 9.4 | 16.8 | 79 | | 3.8 | 6.8 | 79 | |
| *Semibalanus balanoides* (%) | 0 | 0.1 | b | | 0.7 | 18.9 | 2600 | | 0.9 | 11.4 | 1167 | ** | 0 | 0.4 | b | | 0.1 | 0.1 | 0 | |
| *Siphonaria thersites* (#) | 3.8 | 0 | -100 | ** | 21.2 | 0.2 | -99 | *** | 63.2 | 3.2 | -95 | *** | 21.4 | 2.8 | -87 | ** | 36.4 | 10.2 | -72 | *** |
| **Number of animal taxa** | 6.8 | 6.0 | -12 | | 7.8 | 6.6 | -15 | | 12.6 | 9.8 | -22 | ** | 11.2 | 16.0 | 43 | * | 11.6 | 10.0 | -14 | |
| **Dead plants (% cover)** | | | | | | | | | | | | | | | | | | | | |
| Encrusting coralline algae | 0.3 | 8.0 | 2567 | ** | 0 | 0 | 0 | | 0 | 0 | 0 | | 0 | 0 | 0 | | 0.6 | 0 | -100 | |
| *Fucus gardneri* | 1.5 | 7.6 | 407 | | 0.2 | 0.3 | 50 | | 0.2 | 0 | -100 | | 0 | 0.2 | b | | 0.5 | 0.3 | -40 | |
| Oil cover (%) | 0 | 22.5 | b | ** | 0 | 0 | 0 | | 0 | 0 | 0 | | 0 | 0 | 0 | | 0 | 0 | 0 | |

a Abundance not documented.

b Percent change not calculable.

Table 2-5. Comparison of important epibiota from Omni site, 1989, 1992, and 1994.

| | July 1989 | | July 1992 | | July 1994 | |
|---|---|---|---|---|---|---|
| | Pre-treatment | Post-treatment | | | | |
| **Taxon** | **Mean** | **Mean** | **Mean** | **SD** | **Mean** | **SD** |
| *Fucus gardneri* | 25.80 | 2.50 | 68.20 | 17.93 | 41.50 | 21.48 |
| *Balanus crenatus* | 0.30 | 0.75 | 0.00 | - | - | - |
| *Balanus glandula* (5) | 0.00 | 0.00 | 0.10 | 0.21 | - | - |
| *Balanus rostratus (%)* | - | - | - | - | 3.50 | 11.07 |
| *Balanus/Semibalanus* spp. (5) | - | - | - | - | 22.30 | 13.83 |
| *Balanus/Semibalanus* s spp. set (5) | 0.05 | | - | - | 0.80 | 0.86 |
| *Chthamalus dalli* (%) | 0.00 | 0.00 | 0.45 | 0.28 | - | - |
| *Semibalanus balanoides* (% set) | | | 23.00 | 11.78 | - | - |
| *Semibalanus balanoides* (%) | 8.65 | 8.35 | 1.05 | 0.55 | - | - |
| *Semibalanus cariosus* (% set) | - | - | - | - | | |
| *Semibalanus cariosus* (%) | - | 0.50 | 0.00 | | - | - |
| **Total Balanomorpha** | **9.00** | **9.60** | **24.60** | **12.12** | **26.60** | **11.93** |
| | - | - | | | - | - |
| *Mytilus* sp. (% spat) | - | - | 0.40 | 0.61 | 0.20 | 0.35 |
| *Mytilus* cf. *trossulus* (%) | 3.70 | 1.75 | 1.0 | 0.88 | 6.20 | 3.99 |
| | | | - | - | - | - |
| *Fucus gardneri* (% dead) | 0.00 | 17.30 | 0.00 | - | 0.00 | - |
| | - | - | - | - | - | - |
| *Balanus/Semibalanus* spp. (% dead) | 2.15 | 2.50 | 0.15 | 0.34 | 0.45 | 0.28 |
| *Semibalanus balanoides* (% dead) | 0.00 | 0.00 | 0.10 | 0.21 | - | - |

Dash (-) indicates taxon not recorded.

**Table 2-6. Mean abundance (% or no./0.25m$^2$) of important epibiota at North Elrington Island middle rocky stations, June 1994.**

| | Elringtron East | | | Elrington West | | |
|---|---|---|---|---|---|---|
| **Lumped taxon** | **Mean** | **SD** | **Count** | **Mean** | **SD** | **Count** |
| **Plants (% cover)** | | | | | | |
| Encrusting brown algae | 6.75 | 12.20 | 4 | 0.60 | 1.34 | 5 |
| Encrusting red algae | 20.00 | 10.42 | 4 | 6.40 | 6.99 | 5 |
| Endocladiaceae | 0.25 | 0.29 | 4 | 0.60 | 0.55 | 5 |
| Filamentous brown algae | 19.50 | 14.18 | 4 | 7.00 | 13.04 | 5 |
| Filamentous green algae | 2.00 | 2.48 | 4 | 1.30 | 2.64 | 5 |
| Filamentous red algae | 0.00 | 0.00 | 4 | 12.00 | 17.89 | 5 |
| *Fucus gardneri* | 48.75 | 19.31 | 4 | 35.60 | 33.16 | 5 |
| *Fucus gardneri* (germling) | 0.25 | 0.50 | 4 | 0.60 | 0.22 | 5 |
| Gigartinaceae | 5.25 | 6.84 | 4 | 0.80 | 1.79 | 5 |
| Misc. Chlorophyta | 0.50 | 0.00 | 4 | 0.60 | 0.42 | 5 |
| Rhodomelaceae/*Cryptosiphonia* | 0.00 | 0.00 | 4 | 1.70 | 1.64 | 5 |
| **Total pland cover (%)** | **104.00** | | | **68.30** | | |
| **Number of plant taxa*** | **14** | | | **21** | | |
| | | | | | | |
| **Animals (% cover or no./0.25m$^2$)** | | | | | | |
| *Balanus glandula* | 0.00 | 0.00 | 4 | 3.40 | 4.77 | 5 |
| *Chthamalus dalli* | 0.50 | 0.41 | 4 | 0.80 | 0.76 | 5 |
| *Semibalanus balanoides* | 0.00 | 0.00 | 4 | 1.60 | 2.61 | 5 |
| *Littorina scutulata* | 0.00 | 0.00 | 4 | 3.80 | 6.50 | 5 |
| *Littorina sitkana* | 0.00 | 0.00 | 4 | 9.80 | 21.36 | 5 |
| Lottiidae | 1.00 | 1.41 | 4 | 1.60 | 2.51 | 5 |
| Lottiidae (juvenile) | 0.75 | 0.96 | 4 | 17.40 | 32.35 | 5 |
| *Onchidella borealis* | 10.75 | 0.96 | 4 | 2.40 | 5.37 | 5 |
| *Pagurus granosimanus* | 0.00 | 0.00 | 4 | 7.40 | 7.23 | 5 |
| *Pagurus hirsutiusculus* | 25.50 | 28.34 | 4 | 0.20 | 0.45 | 5 |
| *Pagurus* spp. | 0.00 | 0.00 | 4 | 5.40 | 9.53 | 5 |
| *Siphonaria thersites* | 0.00 | 0.00 | 4 | 0.60 | 0.89 | 5 |
| **Number of animal taxa*** | **12** | | | **20** | | |
| | | | | | | |
| **Dead organisms (% cover or no./0.25m2)** | | | | | | |
| *Balanus glandula* | 0.00 | 0.00 | 4 | 0.20 | 0.27 | 5 |
| *Chthamalus dalli* | 0.00 | 0.00 | 4 | 0.20 | 0.27 | 5 |
| *Mytilus* sp. | 0.00 | 0.00 | 4 | 0.20 | 0.45 | 5 |
| *Semibalanus balanoides* | 0.00 | 0.00 | 4 | 0.20 | 0.27 | 5 |
| | | | | | | |
| **Other (% cover)** | | | | | | |
| Boulder/cobble | 99.50 | 1.00 | 4 | 21.00 | 44.22 | 5 |
| Gravel/sand | 0.50 | 1.00 | 4 | 0.00 | 0.00 | 5 |
| Rock | 0.00 | 0.00 | 4 | 79.00 | 44.22 | 5 |

* Number of taxa appearing at a site based on detailed taxonomic data in Appendix C.

**Table 2.7. Mean abundance (% or no./0.25 m2) of important epibiota at lower rocky stations, June 1994 (*p ≤ 0.10).**

| Lumped taxon | Category 1 Mean | Category 1 SD | Category 2 Mean | Category 2 SD | Category 3 Mean | Category 3 SD | t-test 1 vs 2 |
|---|---|---|---|---|---|---|---|
| **Plants (% cover)** | | | | | | | |
| Articulated coraline algae | 1.35 | 1.82 | 0.60 | 0.85 | 0.00 | - | |
| Delesseriaceae | 5.47 | 5.37 | 10.35 | 14.64 | 0.05 | - | |
| *Elachista* spp. | 1.10 | 1.15 | 0.00 | 0.00 | 1.70 | - | |
| Encrusting brown algae | 1.67 | 1.88 | 0.23 | 0.32 | 7.95 | - | |
| Encrusting coralline algae | 2.07 | 1.80 | 0.38 | 0.53 | 0.35 | - | |
| Encrusting red algae | 3.10 | 4.40 | 0.33 | 0.39 | 7.05 | - | |
| Filamentous brown algae | 5.47 | 1.19 | 27.28 | 30.09 | 8.10 | - | |
| Filamentous green algae | 8.20 | 4.60 | 25.03 | 32.99 | 5.00 | - | |
| Filamentous red algae | 7.52 | 8.39 | 5.45 | 5.59 | 0.00 | - | |
| Flagelliform brown algae | 0.40 | 0.28 | 0.73 | 0.60 | 2.05 | - | |
| Foliose green algae | 24.58 | 19.30 | 27.23 | 7.60 | 10.25 | - | |
| *Fucus gardneri* | 34.37 | 20.46 | 17.55 | 9.69 | 49.50 | - | |
| *Fucus gardneri* (germlings) | 0.20 | 0.30 | 0.25 | 0.35 | 2.00 | - | |
| Gigartinaceae | 9.05 | 2.83 | 3.85 | 4.45 | 1.55 | - | |
| *Halosaccion glandiforme* | 9.65 | 3.87 | 0.40 | 0.49 | 0.55 | - | |
| *Laminaria* spp. | 0.60 | 1.04 | 0.00 | 0.00 | 0.00 | - | |
| Misc. Chlorophyta | 0.02 | 0.03 | 0.10 | 0.07 | 0.95 | - | |
| *Palmaria* spp. | 3.78 | 3.28 | 4.43 | 3.92 | 0.00 | - | |
| *Ptilota/Neoptilota* spp. | 2.93 | 1.53 | 1.78 | 2.51 | 0.00 | - | |
| Rhodomelaceae/*Cryptosiphonia* | 16.93 | 4.69 | 30.88 | 9.79 | 10.20 | - | * |
| **Total plant cover (%)** | **139.13** | | **157.15** | | **107.55** | | |
| **Number of plant taxa*** | **37.33** | | **27.50** | | **23.00** | | * |
| **Animals (%cover or no./0.25m²)** | | | | | | | |
| *Balanus/Semibalanus* spp. (set) | 3.40 | 5.89 | 0.45 | 0.07 | 0.30 | - | |
| *Chthamalus dalli* | 0.58 | 0.77 | 0.13 | 0.11 | 0.55 | - | |
| Encrusting bryozoan | 5.38 | 1.17 | 0.80 | 1.13 | 0.70 | - | * |
| Mytilidae (spat) | 0.32 | 0.31 | 0.65 | 0.57 | 0.35 | - | |
| *Mytilus* cf. *trossulus* | 0.00 | 0.00 | 0.23 | 0.32 | 0.00 | - | |
| *Semibalanus cariosus* | 9.88 | 17.08 | 0.00 | 0.00 | 0.00 | - | |
| Spirorbidae | 0.60 | 0.40 | 0.30 | 0.35 | 0.20 | - | |
| *Actiniaria* | 2.77 | 4.71 | 0.05 | 0.07 | 0.00 | - | |
| *Lacuna* spp. | 0.93 | 1.53 | 0.35 | 0.49 | 0.10 | - | |
| *Littorina scutulata* | 0.13 | 0.15 | 0.05 | 0.07 | 10.00 | - | |
| *Littorina sitkana* | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 | - | |
| Lottiidae | 0.67 | 0.65 | 1.20 | 1.56 | 21.40 | - | |
| Lottiidae (juvenile) | 3.23 | 2.95 | 8.30 | 11.74 | 39.60 | - | |
| Nemertea | 0.73 | 0.21 | 0.20 | 0.28 | 0.50 | - | |
| *Nucella lameliosa* | 13.03 | 21.62 | 0.20 | 0.14 | 0.00 | - | |
| *Nucella lima* | 0.00 | 0.00 | 0.35 | 0.49 | 0.00 | - | |
| *Pagurus hirsutiusculus* | 2.37 | 2.37 | 2.15 | 2.47 | 10.70 | - | |
| *Searlesia dira* | 1.50 | 2.60 | 0.35 | 0.49 | 0.30 | - | |
| **Number of animal taxa*** | **28.33** | | **24.50** | | **26.00** | | |
| **Dead organisms (% cover or no./925m²)** | | | | | | | |
| *Mytilus* sp. | 15.03 | 25.61 | 1.95 | 1.63 | 0.20 | - | |
| **Other (% cover)** | | | | | | | |
| Boulder/cobble | 11.80 | 6.98 | 81.75 | 16.62 | 0.00 | - | * |
| Gravel/sand | 1.70 | 2.44 | 3.25 | 3.89 | 2.00 | - | |
| Rock | 86.50 | 5.72 | 14.75 | 20.86 | 98.00 | | * |
| **Number of stations** | **3** | | **3** | | **3** | | |

Number of taxa apearing at a site based on detailed taxonomic data in Appendix C.

Table 2-8. **Mean abundance (% or no./0.25m$^2$) of important epibiota at middle and lower mixed-soft Northwest Bay West Arm stations, June 1994.**

| | Northwest Bay West Arm (mid) | | | Northwest Bay West Arm (low) | | |
|---|---|---|---|---|---|---|
| **Lumped taxon** | **Mean** | **SD** | **Count** | **Mean** | **SD** | **Count** |
| **Plants (% cover)** | | | | | | |
| Encrusting brown algae | 0.15 | 0.24 | 10 | 0.60 | 0.32 | 10 |
| Endocladiaceae | 0.05 | 0.16 | 10 | 2.40 | 2.29 | 10 |
| Filamentous brown algae | 0.00 | 0.00 | 10 | 1.80 | 1.69 | 10 |
| Filamentous green algae | 0.00 | 0.00 | 10 | 8.75 | 11.45 | 10 |
| Filamentous red algae | 0.00 | 0.00 | 10 | 1.55 | 3.08 | 10 |
| Flagelliform brown algae | 0.00 | 0.00 | 10 | 2.20 | 4.66 | 10 |
| Foliose green algae | 0.00 | 0.00 | 10 | 8.35 | 18.75 | 10 |
| *Fucus gardneri* | 0.20 | 0.63 | 10 | 10.90 | 12.59 | 10 |
| *Fucus gardneri* (germlings) | 0.05 | 0.16 | 10 | 0.65 | 0.53 | 10 |
| *Halosaccion glandiforme* | 0.00 | 0.00 | 10 | 0.50 | 0.67 | 10 |
| Rhodomelaceae/*Cryptosiphonia* | 0.05 | 0.16 | 10 | 3.20 | 6.69 | 10 |
| **Total pland cover (%)** | **0.65** | | | **41.30** | | |
| **Number of plant taxa*** | **5** | | | **20** | | |
| | | | | | | |
| **Animals (% cover or no./0.25m$^2$)** | | | | | | |
| *Balanus glandula* | 7.30 | 2.79 | 10 | 0.05 | 0.16 | 10 |
| *Chthamalus dalli* | 0.65 | 0.75 | 10 | 0.65 | 0.47 | 10 |
| *Semibalanus balanoides* | 1.70 | 1.62 | 10 | 0.05 | 0.16 | 10 |
| *Littorina scutulata* | 359.40 | 196.88 | 10 | 297.70 | 138.66 | 10 |
| *Littorina sitkana* | 76.40 | 81.46 | 10 | 0.90 | 1.37 | 10 |
| Lottiidae | 12.00 | 6.06 | 10 | 1.80 | 2.74 | 10 |
| Lottiidae (juvenile) | 0.00 | 0.00 | 10 | 66.10 | 31.72 | 10 |
| *Mytilidae* (spat) | 0.50 | 0.82 | 10 | 0.55 | 1.26 | 10 |
| *Mytilus* cf. *trossulus* | 8.80 | 5.29 | 10 | 7.50 | 14.77 | 10 |
| *Pagurus hirsutiusculus* | 0.20 | 0.63 | 10 | 4.70 | 4.42 | 10 |
| Pholidae/Stichaeidae | 0.00 | 0.00 | 10 | 0.50 | 0.85 | 10 |
| **Number of animal taxa*** | **10** | | | **20** | | |
| | | | | | | |
| **Dead organisms (% cover or no./0.25m$^2$)** | | | | | | |
| *Balanus glandula* | 0.50 | 0.33 | 10 | 0.10 | 0.21 | 10 |
| *Mytilus* sp | 1.50 | 1.90 | 10 | 2.10 | 3.18 | 10 |
| | | | | | | |
| **Other (% cover)** | | | | | | |
| Boulder/cobble | 81.50 | 29.25 | 10 | 35.80 | 25.09 | 10 |
| Gravel/sand | 18.50 | 29.25 | 10 | 64.20 | 25.09 | 10 |

* Number of taxa appearing at a site based on detailed taxonomic data in Appendix C.

## *Biological Conditions*

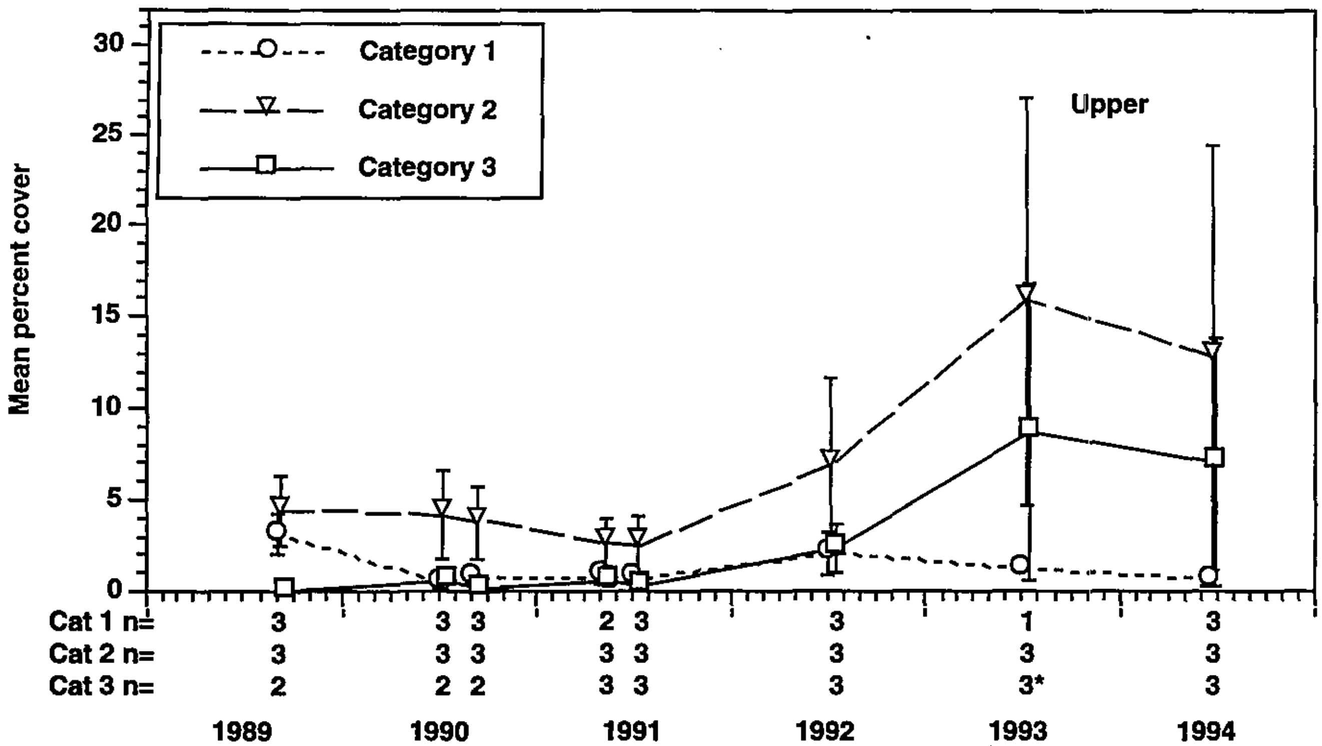
Eighteen rocky sites and one mixed-soft site were sampled at one or more elevations in late June 1994 (see Table 1-1). Several sites last visited in 1992 were resampled, including the boulder/cobble beach at the Omni-Barge test site. Data on the omni site are presented with the middle rocky stations. Detailed data on taxon abundances by individual station are provided in Appendix Tables B-1-2 through B1-4; B-2-1, B2-2.

### Upper Rocky Stations

At upper rocky stations, the rockweed *Fucus gardneri* was found at low abundances at all categories through 1991 (Figure 2-1, upper) reflecting the initial selection in 1989 of upper stations at the top of the obvious zone of attached macrobiota. By 1992 the mean percent cover of *Fucus* at oiled upper stations (both Category 2 and 3) began to increase markedly compared with Category 1 stations (Figure 2-1). *Fucus* cover at the Category 2 and 3 stations increased through 1993 (to 15.4 and 8.7 mean percent cover, respectively) then declined slightly in 1994.

Fauna associated with the *Fucus* community, such as the periwinkles *Littorina scutulata* and *L. sitkana*, showed similar changes in abundance during this period. The mean abundance of littorines for all three site categories of upper stations was relatively low in 1991 (Figure 2-2). By 1992 littorine abundance had begun to increase and *L. sitkana* peaked in 1993 at all three categories. Since 1991 *L. scutulata* has gradually increased at Category 1 sites. Populations of *L. scutulata* increased each year through 1993 at Category 2 sites then declined in 1994. The abundance of *L. scutulata* at the Category 3 sites peaked in 1992 and then declined until the abundance was lower, but not significantly lower, than the Category 1 and 2 sites in 1994.

The mean density of Lottiidae (limpets) at Category 1 sites was consistently greater than the density at the oiled sites through 1992 (Figure 2-3). The sharp decline in abundance at Category 1 sites in 1993 reflects the fact that only a single Category 1 upper site (Eshamy Bay) was sampled. Eshamy Bay has consistently had lower densities of Lottiidae in the upper intertidal than other Category 1 sites. In 1994 the Lottiidae population declined at the Category 3 sites but continued to increase at the Category 2 sites. No significant category effects were found in biological variables at upper rocky stations in 1994 (Table 2-1).




* Includes estimated *Fucus* cover for Northwest Bay Rocky Islet determined from quadrat photographs.

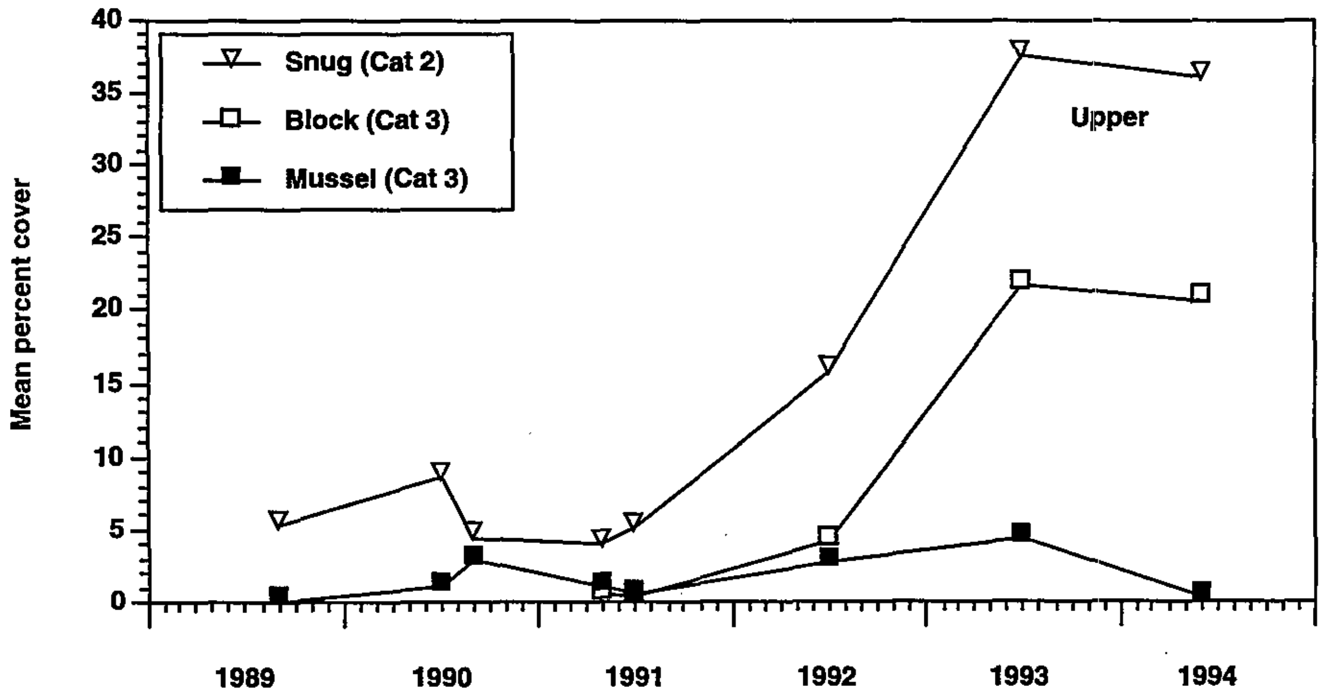



**Figure 2-1** **Mean percent cover (±1 SE) of *Fucus* from upper rocky stations, by category and from selected upper rocky stations 1989-94. Number of stations sampled (n) for each category shown below axis.**

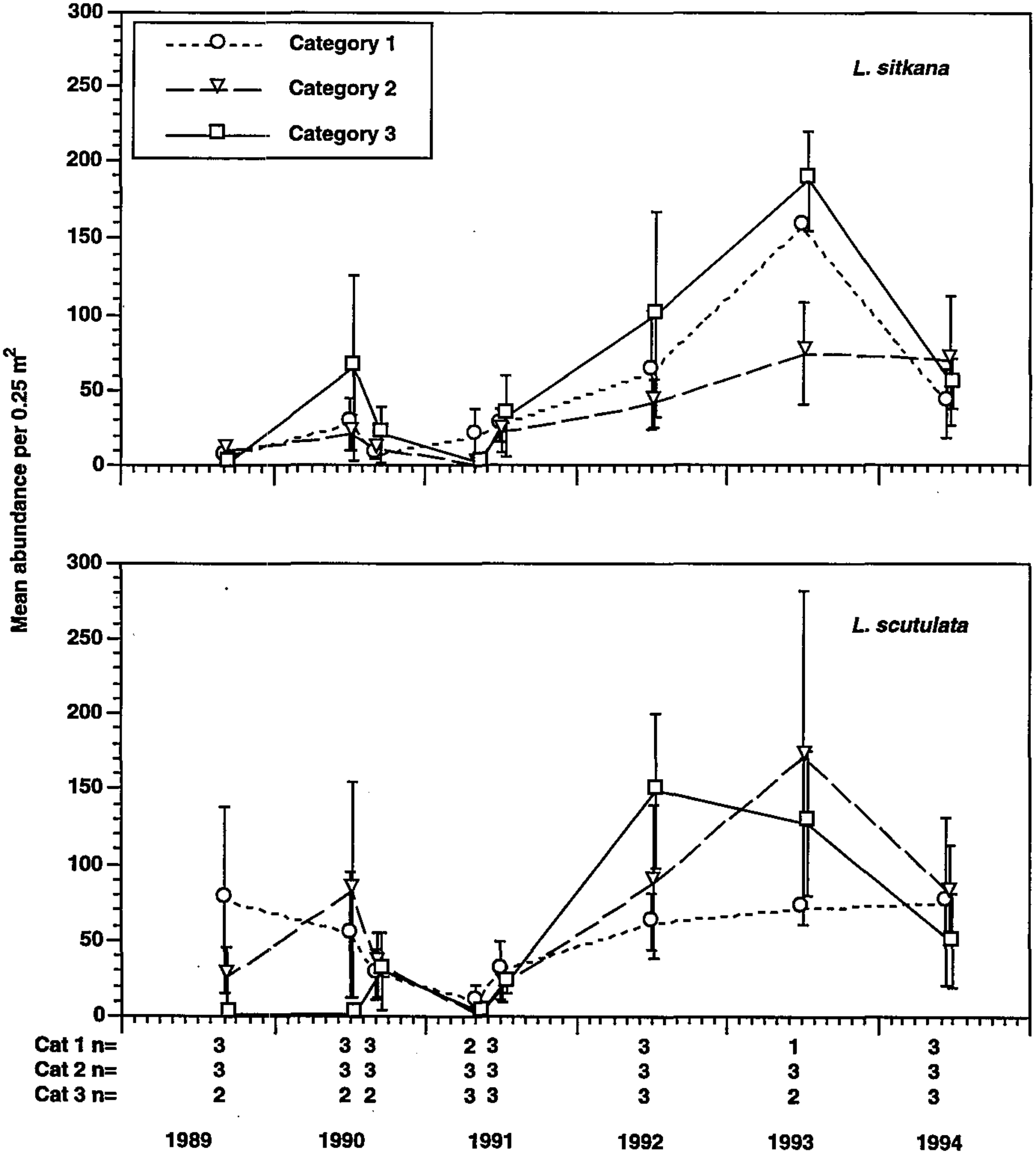



Figure 2-2 Mean abundance (±1 SE) of littorine snails from upper rocky stations, by category 1989-94.

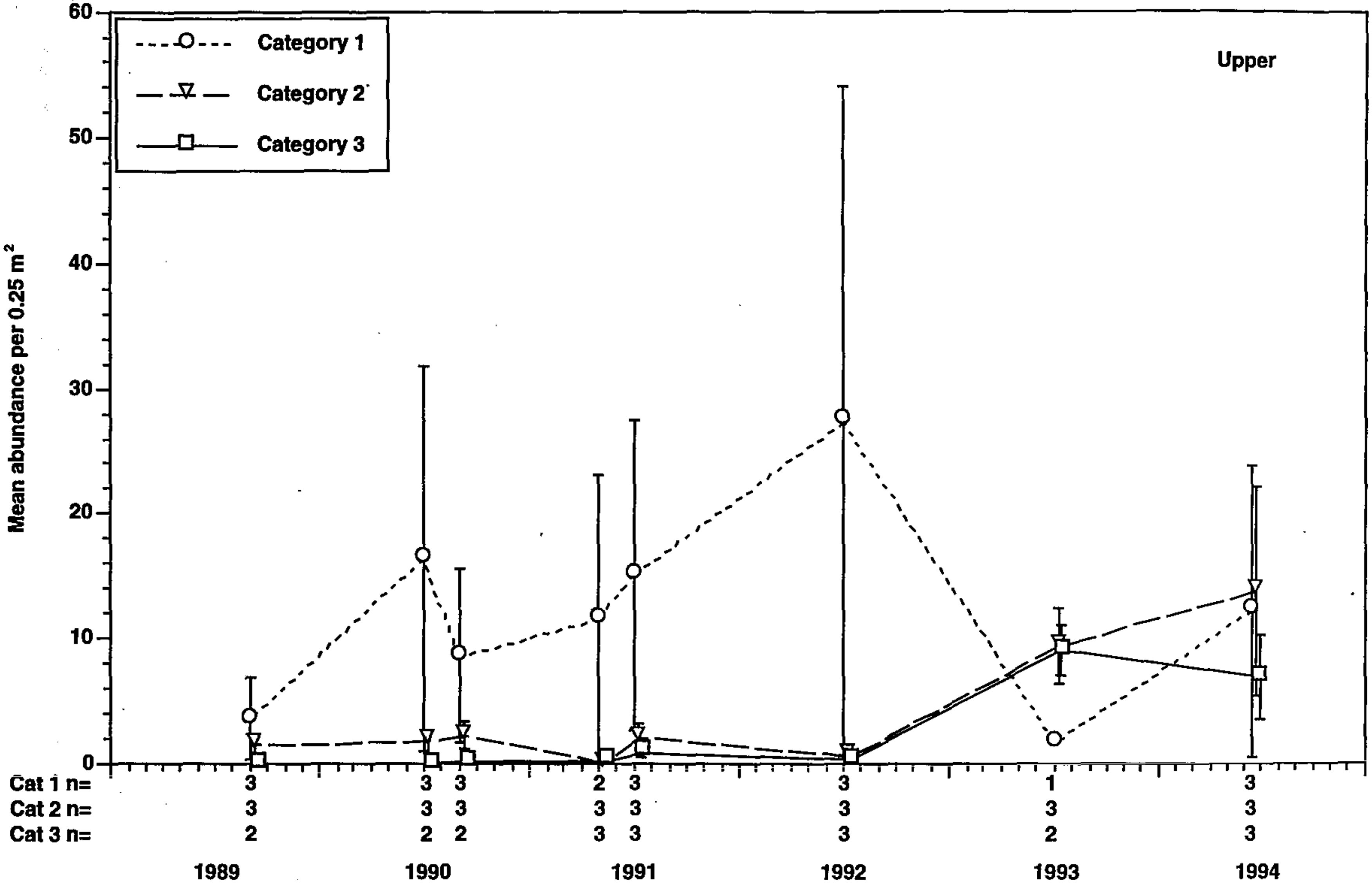



**Figure 2-3** **Mean abundance (±1 SE) of Lottiidae from upper rocky stations, by category 1989-94.**

North Elrington Islet Upper Rocky Stations

The North Elrington Islet stations were first qualitatively surveyed in July 1992. The three Category 3 sites were presumed to have had similar oiling and treatment histories, based on State of Alaska records and 1989 observations. The sites are characterized by differing degrees of exposure that were expected to result in different patterns of recovery.

Significant differences in the abundance and percent cover of the community dominants were detected among the three sides of the islet in 1992. Significant differences in community composition remained in 1994 (Table 2-2).

*Fucus* cover decreased at all three stations (Figure 2-4). The Elrington Islet North site (most exposed to wave action) and the Elrington Islet West site continued to have significantly higher *Fucus* cover than the East site, a pattern that was also apparent in 1992. Encrusting red algae (*Hildenbrandia rubra*) showed a similar pattern (Table 2-2).

*L. scutulata* continued to be significantly more abundant at the Elrington Islet East site in 1994 (Figure 2-4). *L. sitkana* abundance remained higher but not significantly higher at the West site. Cover of mussels and abundance of limpets were similar at all three upper stations in 1994.

Overall, differences in dominant taxa among the three sites were less in 1994 than in 1992, indicating a pattern of recovery. The East site, which receives the greatest insolation, appears to be recovering more slowly.

Middle Rocky Stations

The difference in mean cover of *Fucus* seen in July 1990, when there were lower values at the oiled Category 2 and Category 3 sites compared to the unoiled Category 1 sites, had disappeared by July 1991 (Figure 2-5). *Fucus* cover at the oiled middle stations increased through 1993 until mean percent cover exceeded the mean for the Category 1 sites, which had declined somewhat over the same period. *Fucus* cover decreased at Category 2 and 3 sites in 1994 reflecting a general senescence of the mature rockweed community at these stations (Figure 2-5). *Fucus* cover at the unoiled Category 1 sites increased in 1994, but the long-term trend appears to be relatively stable compared to the trends found at the previously oiled sites. Temporal patterns in *Fucus* cover at selected middle rocky stations (Figure 2-6) reflect the overall patterns for their respective categories.

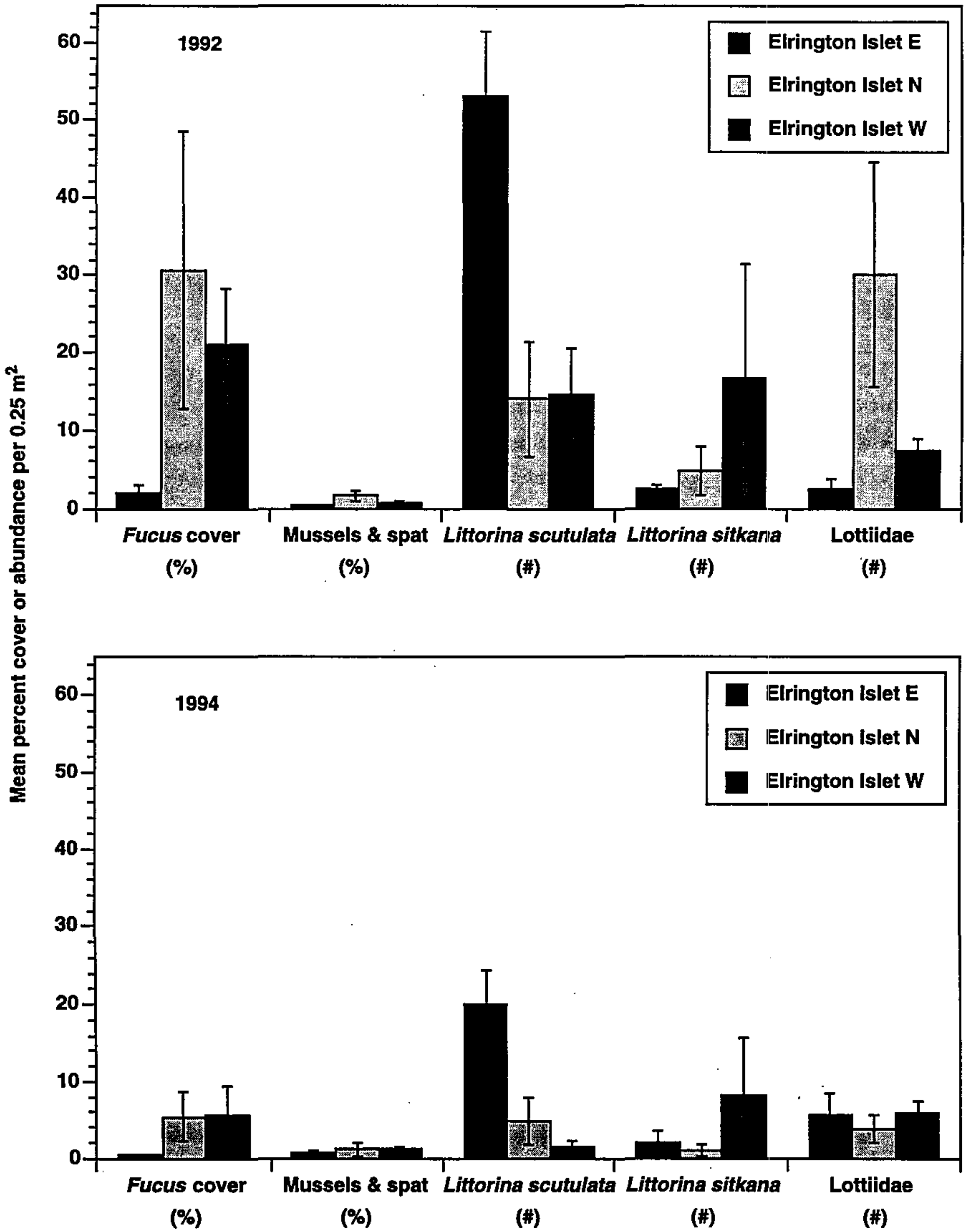



**Figure 2-4 Mean percent cover or abundance of selected epibiota at the North Elrington Islet upper rocky intertidal site, 1992 and 1994.**

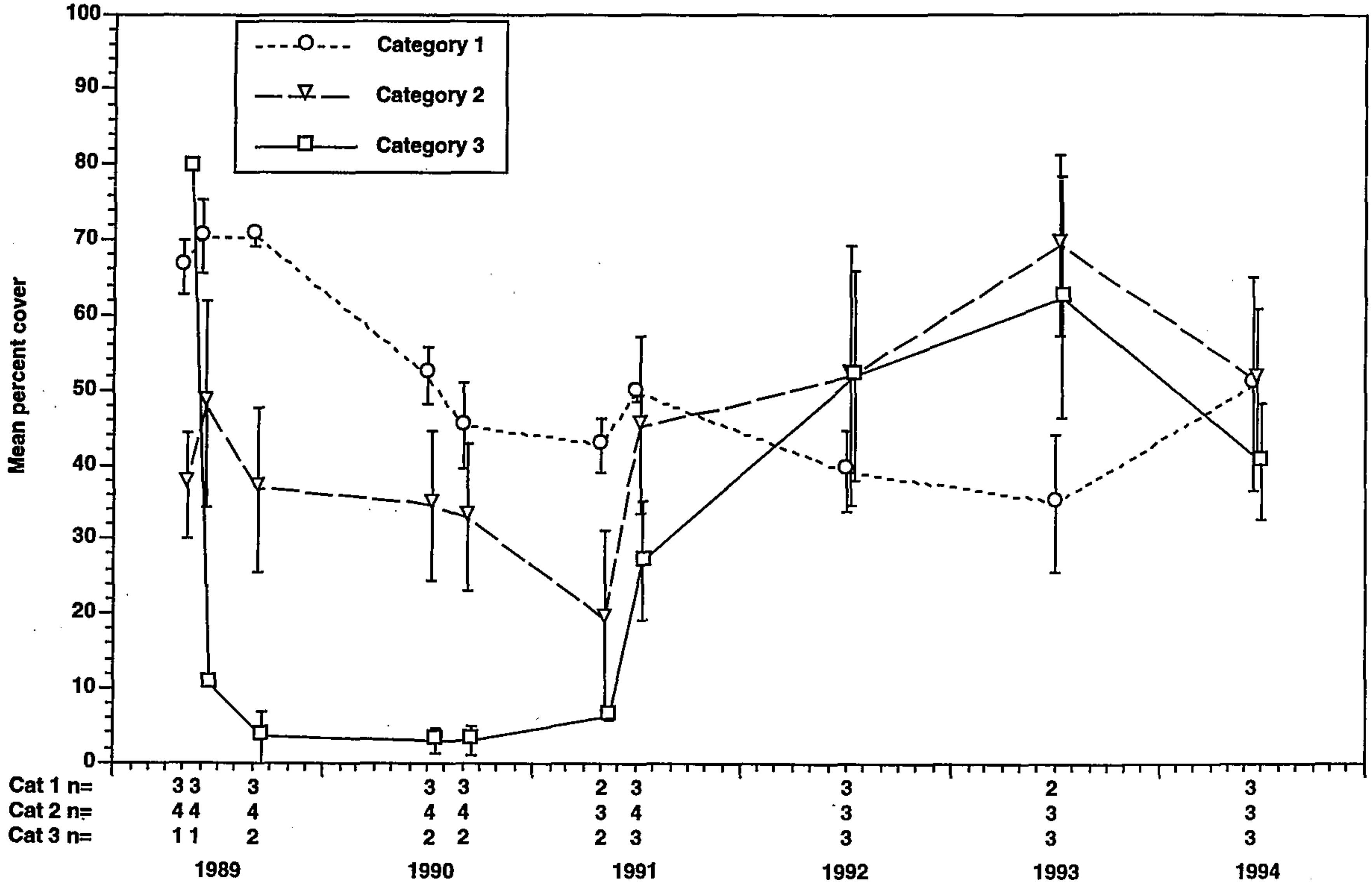



**Figure 2-5** **Mean percent cover (±1 SE) of *Fucus* from middle rocky stations, by category 1989-94.**

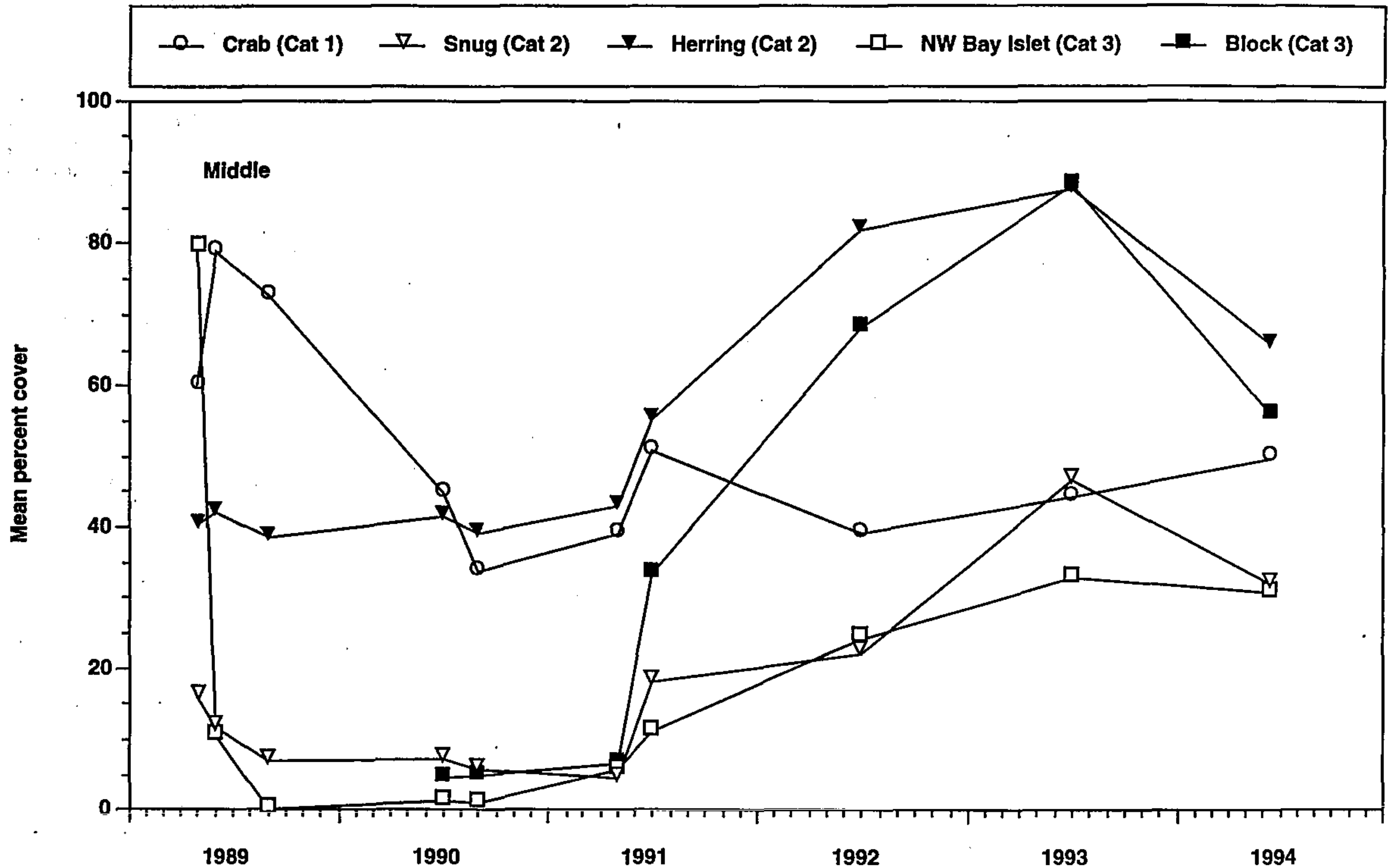



**Figure 2-6** **Mean percent cover of *Fucus* from selected middle rocky stations, 1989-94.**

*Fucus* germling recruitment at the Category 1 sites has varied over time but has averaged approximately 1 percent cover during the six years of the study (Figure 2-7). The higher *Fucus* cover at the oiled sites in 1993 is attributed to the greater recruitment and increased survival of *Fucus* germlings at Category 2 and 3 sites in 1990 and 1991. As the cover of mature *Fucus* increased, germling cover at the Category 2 and 3 sites decreased in 1992 to levels below, but not significantly below, the mean for the Category 1 sites.

Littorines decreased in abundance slightly at all three categories in 1994 (Figure 2-8). In general, sites with deceased *Fucus* cover (Figure 2-6) showed corresponding decreases in abundances of *L. sitkana* and *L. scutulata* (Figures 2-9 and 2-10, respectively). Exceptions to this trend in 1994 include Block Island, with a slight increase in abundance of *L. scutulata* and Snug Harbor with a slight increase in *L. sitkana* numbers; *Fucus* declined in 1994 at both stations.

Limpets (Lottiidae) showed a significant category effect in 1994 (Table 2-3). The larger limpets showed a highly significant category effect in ANOVA, and Category 3 stations had significantly higher densities than Category 1 or 2 stations; quite the opposite of the situation in 1989 through 1991 (Figure 2-11). Juvenile limpets also showed an opposite effect with greater densities of juveniles being found at the Category 1 stations. Combined counts of the juvenile and larger limpets showed a decrease in mean abundance at the Category 1 sites, little change at the Category 2 sites, and an increase at the Category 3 sites (Figure 2-11). Limpets at selected middle rocky sites (Figure 2-12) showed increased abundance with the exception of the Herring Bay (Category 2) site that showed a 25 percent decrease from the very high 1993 values. Since 1989 the mean abundance of limpets has generally increased each year at the Category 2 and 3 sites as recovery progressed in response to the increased *Fucus* cover.

Mean percent cover of mussels decreased at Category 1 and 2 sites in 1994 but increased at the Category 3 sites (Figure 2-13). From 1991 through 1993, mussel populations have increased within all three categories. Exceptions to this pattern were found at Outside Bay (Category 2) and Northwest Bay West Arm (Category 3) where mussel populations have remained low since 1989.

Barnacle cover in 1994 increased at Category 1 and 2 sites and continued to decrease at Category 3 sites (Figure 2-14). Year to year trends in barnacle cover for the Category 1 sites appear stable but individual sites show wide fluctuations in percent cover. Category 2 sites show similar trends in mean percent cover. Barnacle populations, severely impacted at Category 3 sites during treatment in 1989, rebounded in the summer of 1991. A large set of the opportunistic barnacle *Semibalanus balanoides* contributed to a higher cover at Category 3 sites than at the Category 1 or 2 sites. Since 1991, mean barnacle cover at Category 3 sites has decreased. Cover at the Category 3 sites in 1994 was again lower than at the Category 1 or Category 2 sites, but not significantly so.

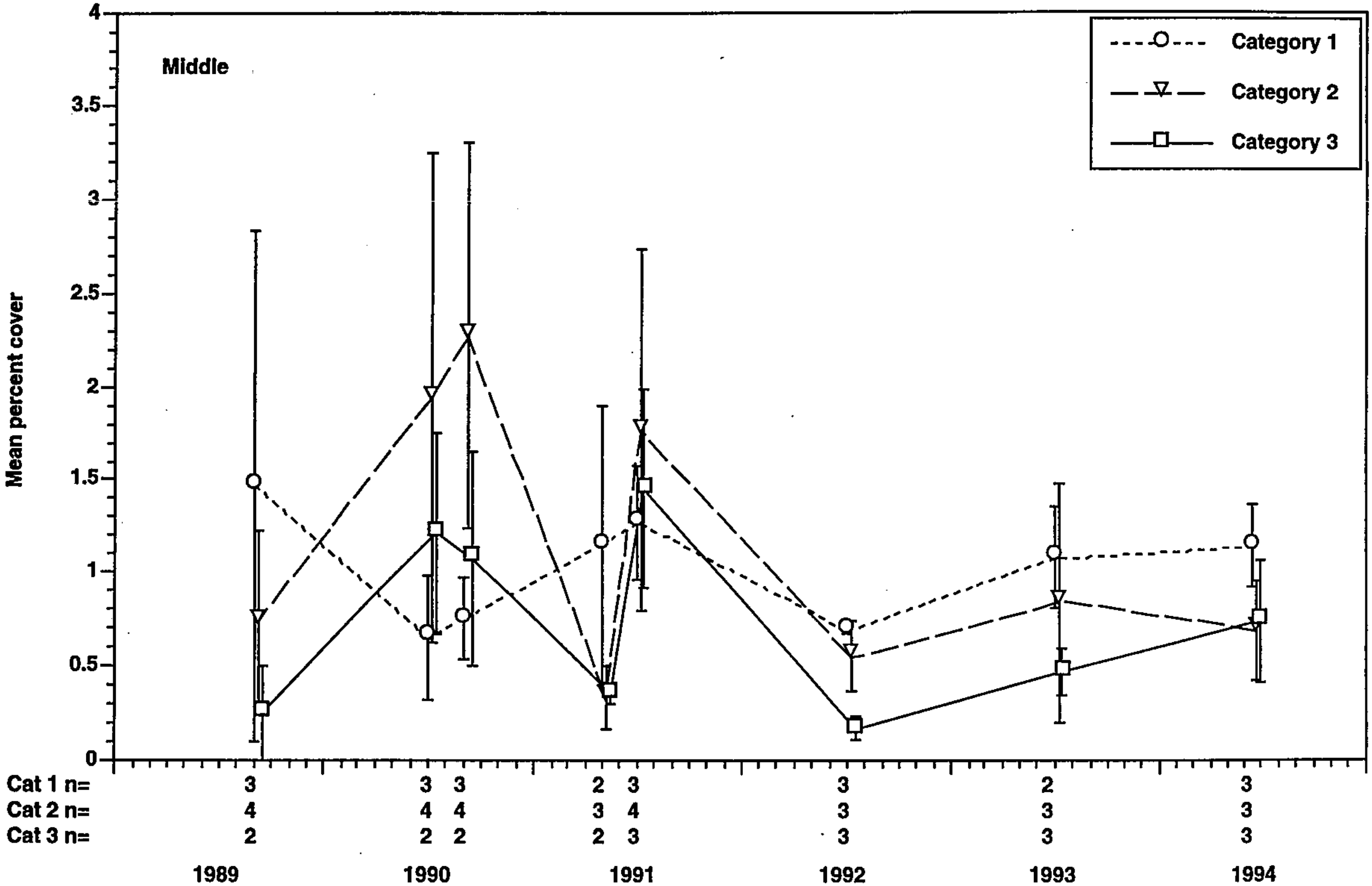



**Figure 2-7** **Mean percent cover (±1 SE) of *Fucus* germlings from middle rocky stations, by category 1989-94.**

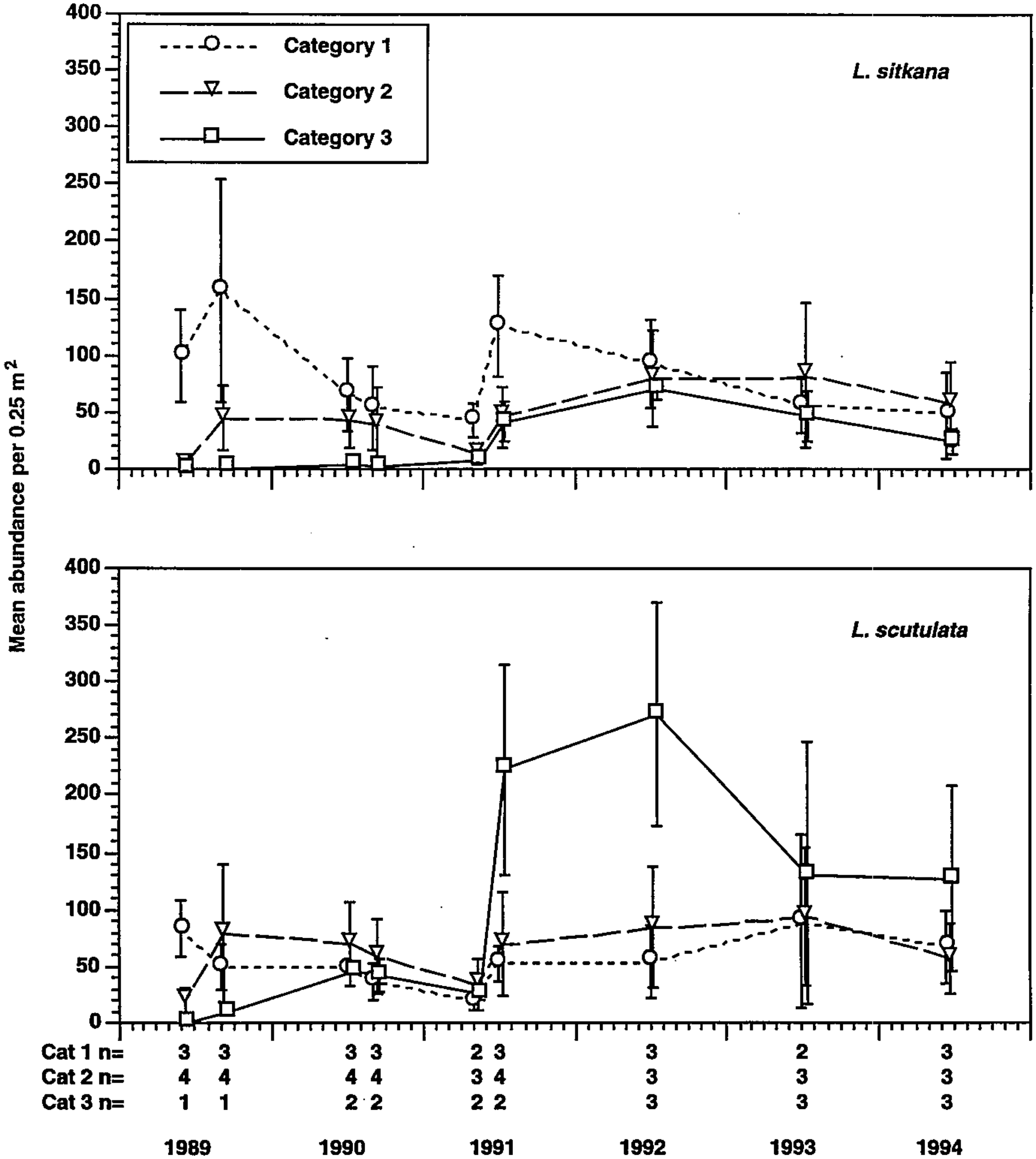



**Figure 2-8 Mean abundance (±1 SE) of littorine snails from middle rocky stations, by category 1989-94.**

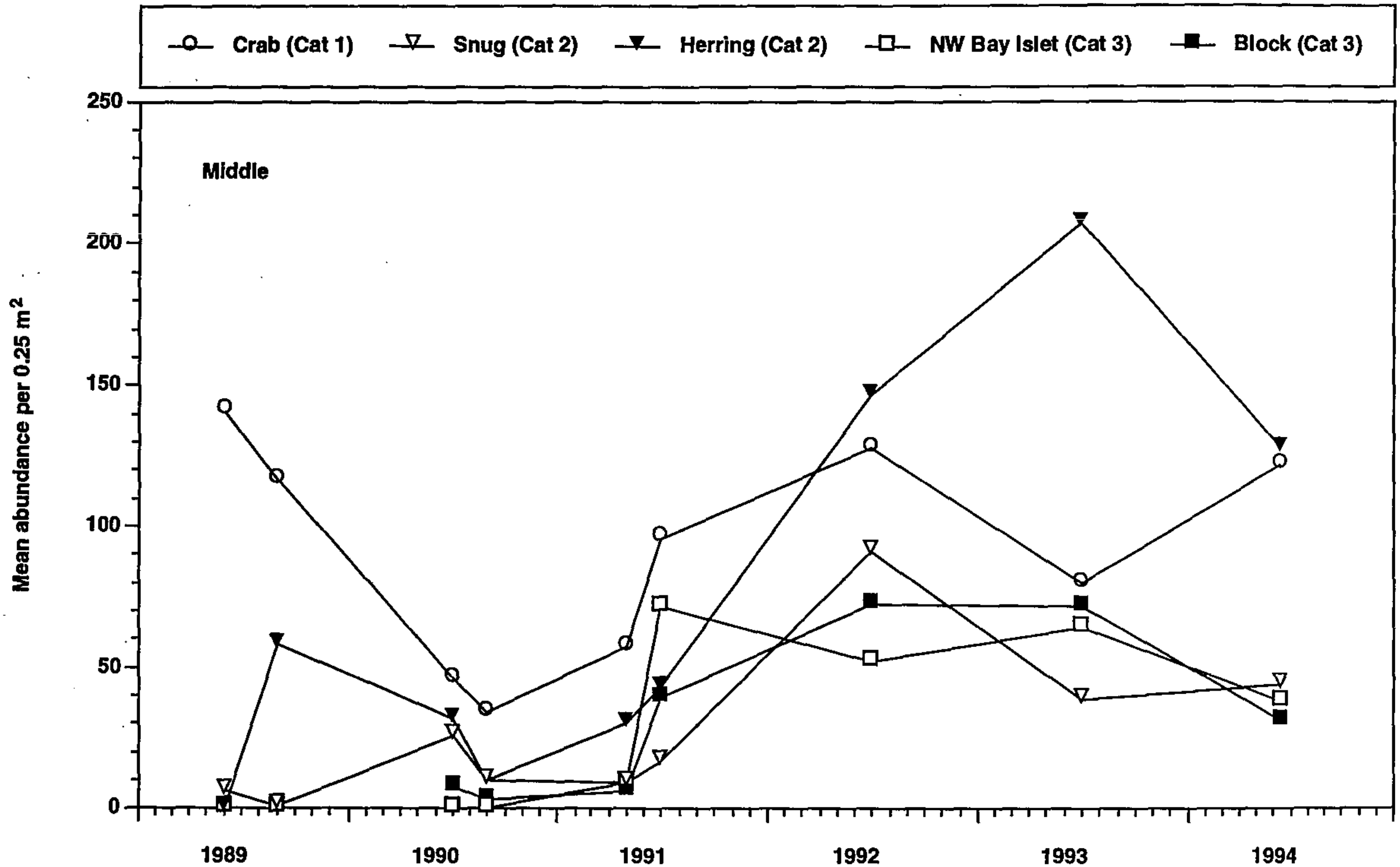



**Figure 2-9** Mean abundance of ***Littorina sitkana*** from selected middle rocky stations, 1989-94.

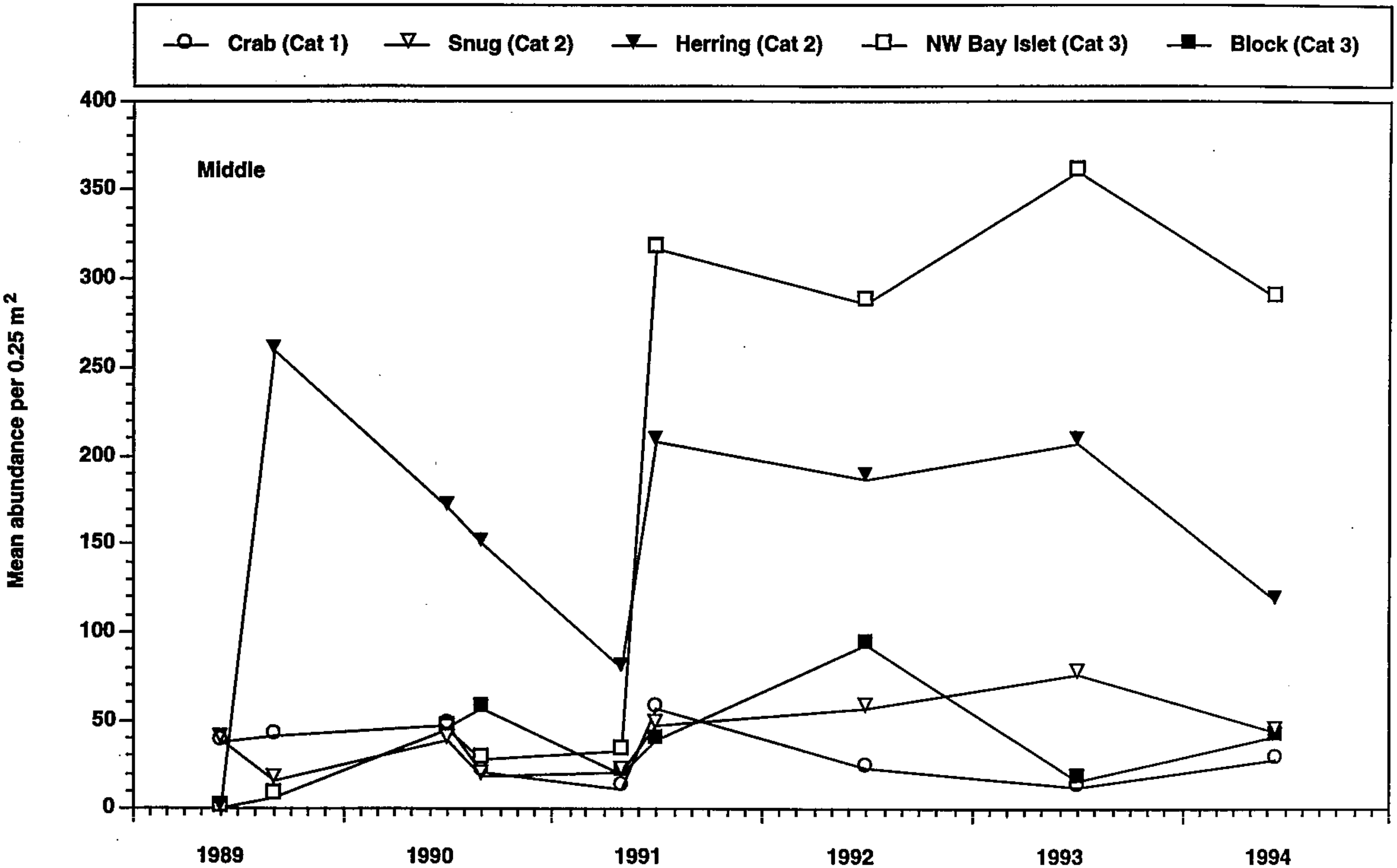



Figure 2-10 Mean abundance of *Littorina scutulata* from selected middle rocky stations, 1989-94.

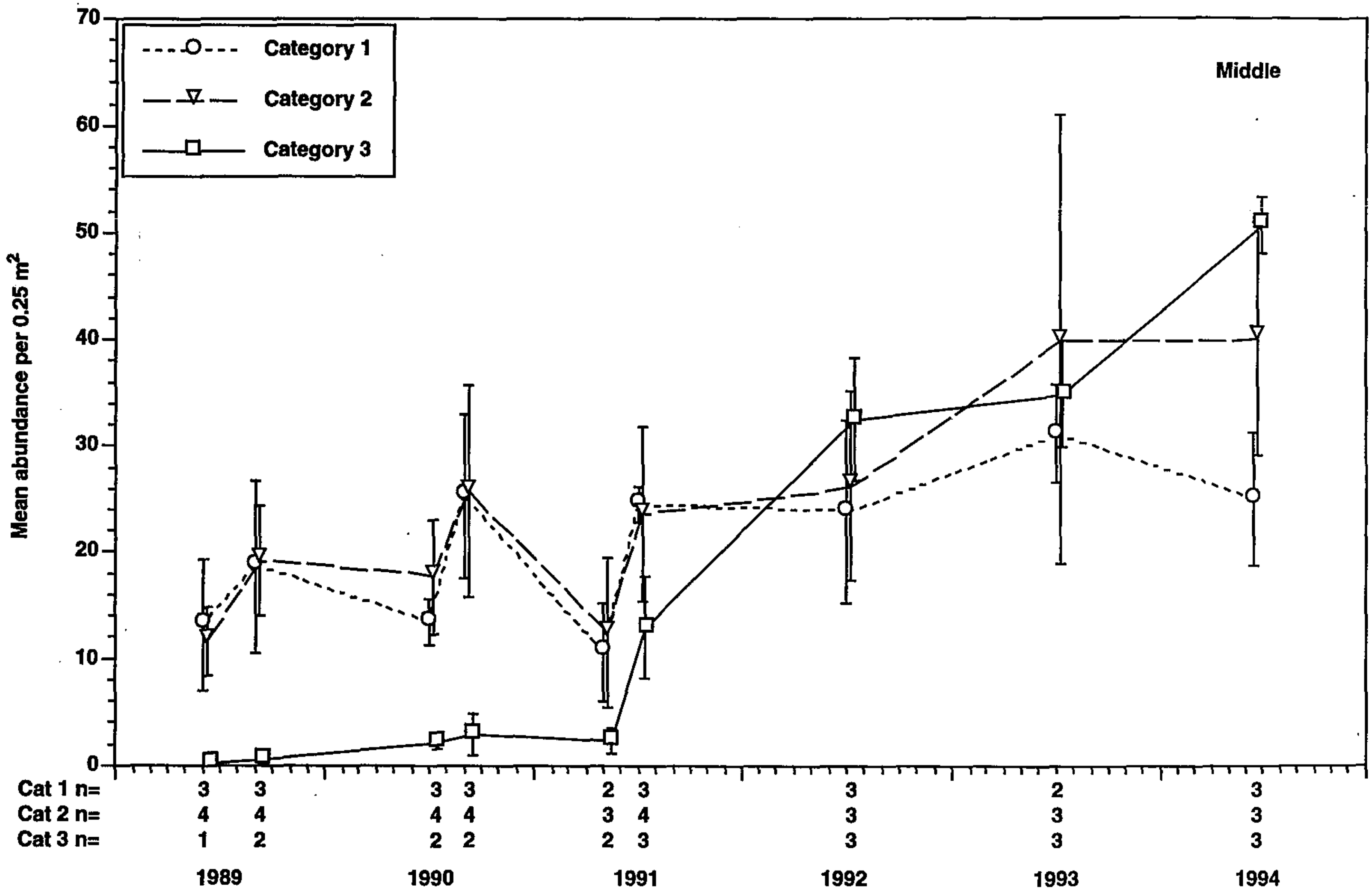



Figure 2-11 Mean abundance (±1 SE) of Lottiidae from middle rocky stations, by category 1989-94.

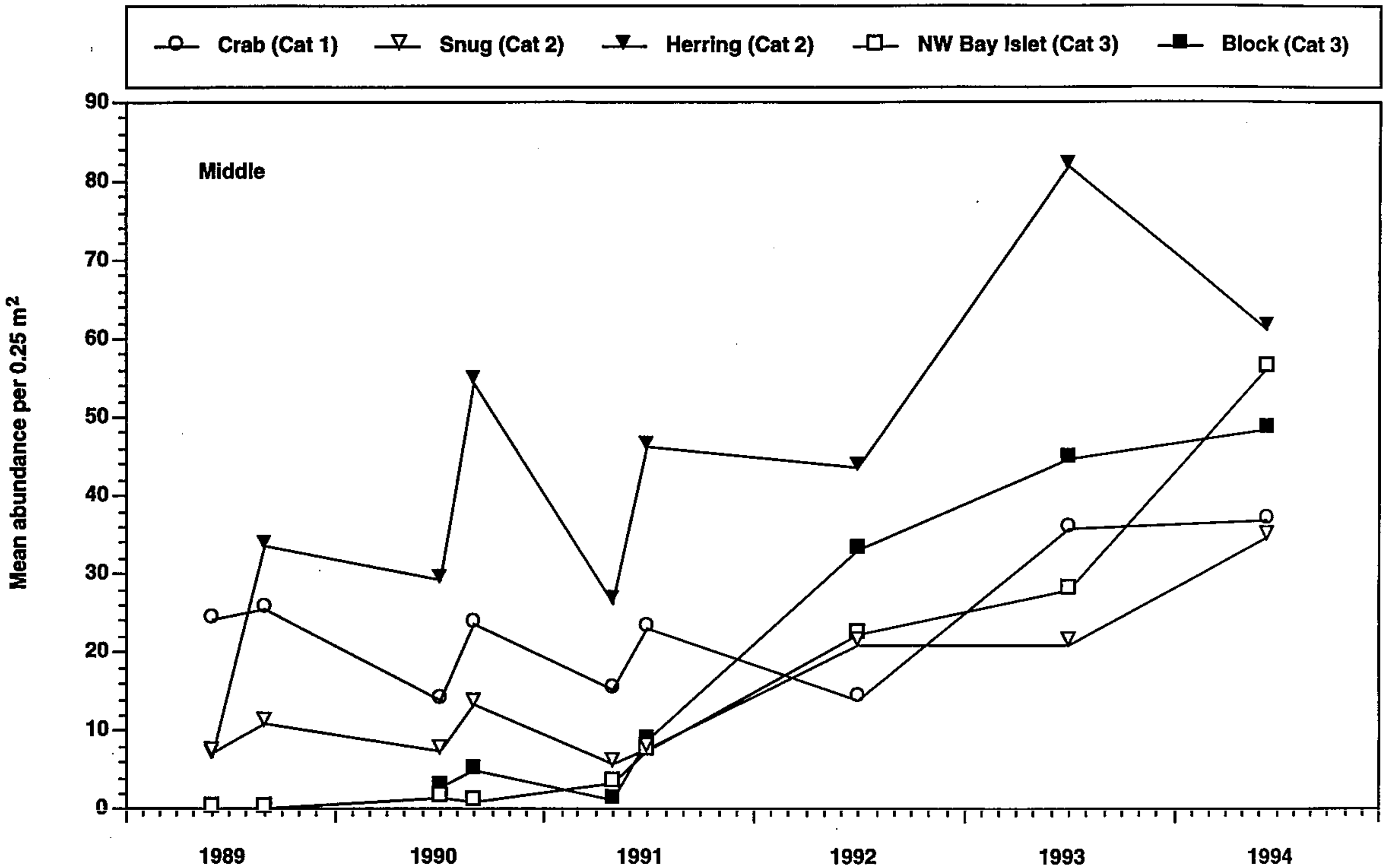



**Figure 2-12** **Mean abundance of Lottiidae from selected middle rocky stations, 1989-94.**

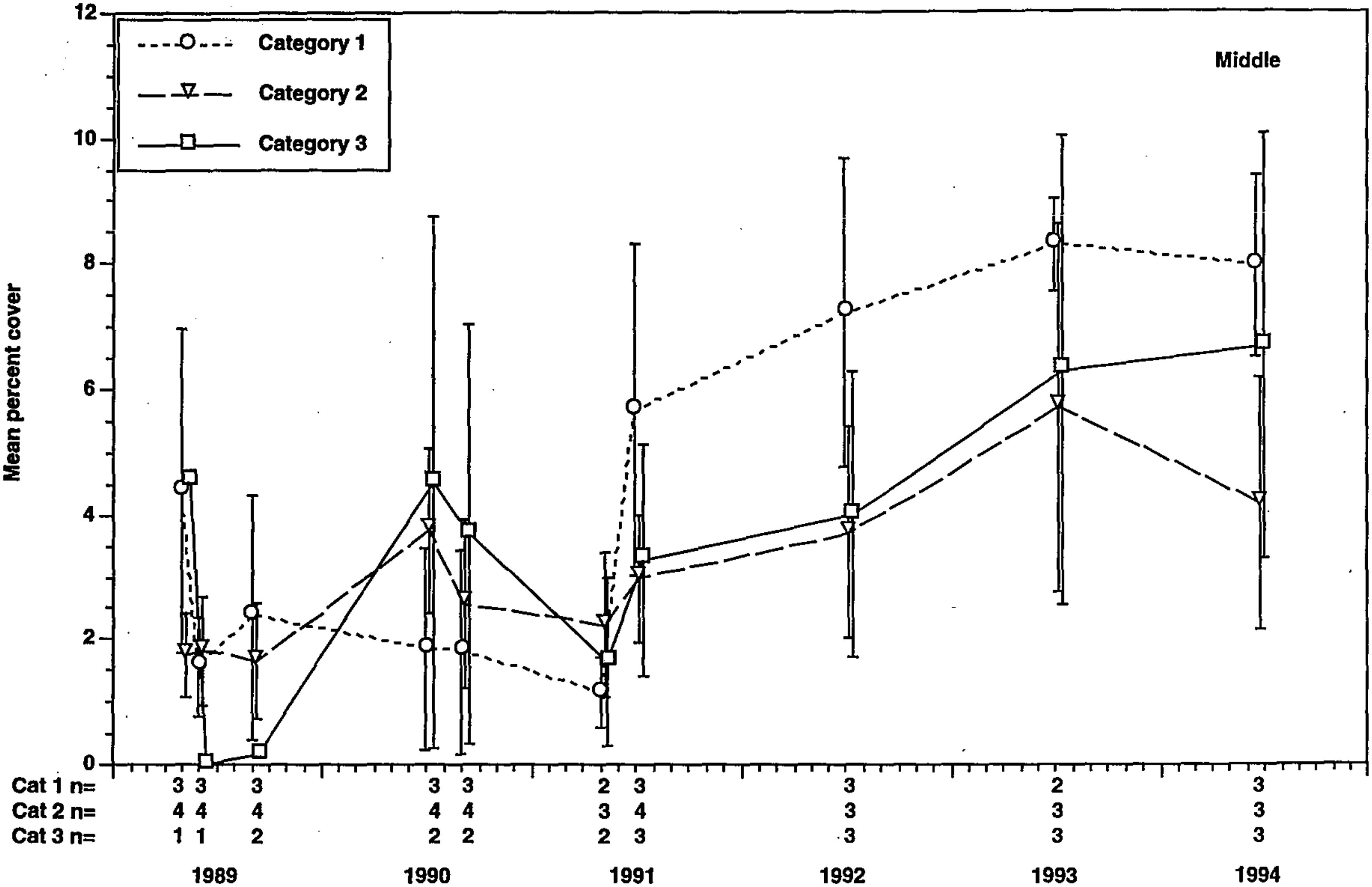



**Figure 2-13** **Mean percent cover (±1 SE) of mussels from middle rocky stations, by category 1989-94.**

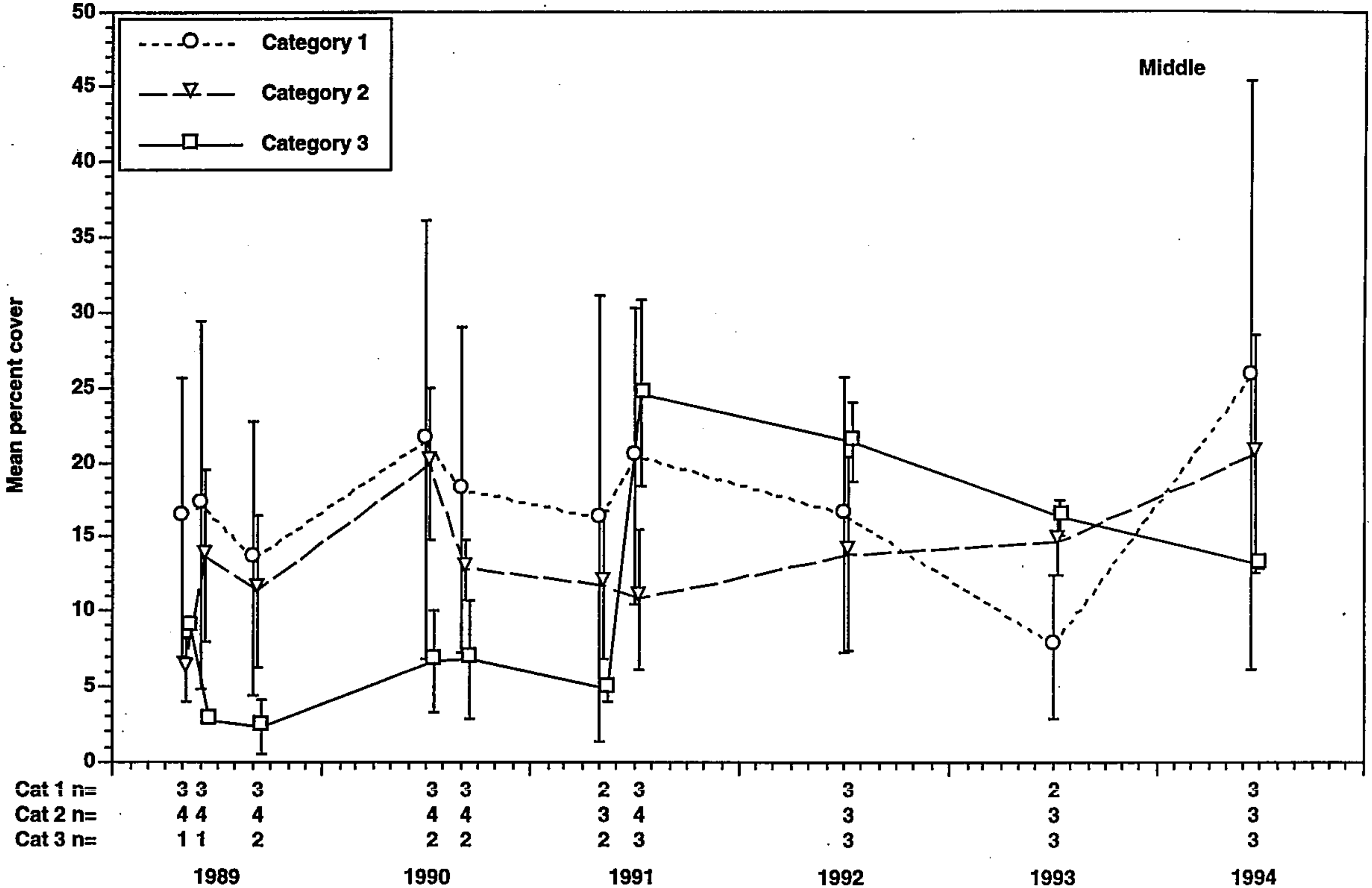



**Figure 2-14** **Mean percent cover (±1 SE) of Balanomorpha from middle rocky stations, by category 1989-94.**

The primary predator on barnacles and mussels at the middle rocky stations is the drill *Nucella*. Two species, *N. lima* and *N. lamellosa*, are present, and *N. lamellosa* is the more abundant. A significant category effect was found for *N. lamellosa* in ANOVA, Category 1 sites having significantly greater abundance than the Category 3 sites (Table 2-3). The large number of *N. lamellosa* found at Hogg Bay (38/0.25 $m^2$) was largely responsible for this difference. *Nucella* at the Category 1 sites has continued to increase from the 1991 levels (Figure 2-15) and likely reflects this predator's response to increased mussel cover. During this sam e period, barnacle cover decreased through 1993 and then rebounded. *Nucella* abundance at Category 2 sites increased from 1991 through 1993 and declined in 1994, following a similar pattern for mussels. *Nucella* abundance at Category 3 sites peaked in 1992 and then declined.

Northwest Bay West Arm Middle Stations

When first sampled in September 1989, the Category 3 middle station at the Northwest Bay West Arm rocky site had significantly greater oil cover and significantly greater cover by dead coralline algae (both $p < 0.05$) than did the adjacent reference site that did not appear to have been hot-water washed (Table 2-4). This, and the other patterns described below, suggest that the treatment was both ineffective at oil removal and immediately damaging to the epibiota.

Total algal cover and total *Fucus* cover at the middle elevation reference station remained relatively constant from 1989 through 1993 (Table 2-4; Figures 2-16, 2-17). The slight decline in *Fucus* cover begun in 1993 led to a sharp dieoff in 1994 (Figure 2-17). Total cover and *Fucus* cover at the Category 3 middle station increased steadily beginning in 1990 (based on photographic documentation) and showed substantial recovery by July 1993 relative to the adjacent middle reference station. *Fucus* cover at the Category 3 station declined to 34 percent in 1994 because of the senescence of the dominant year class that had set as germlings in 1989 following treatment.

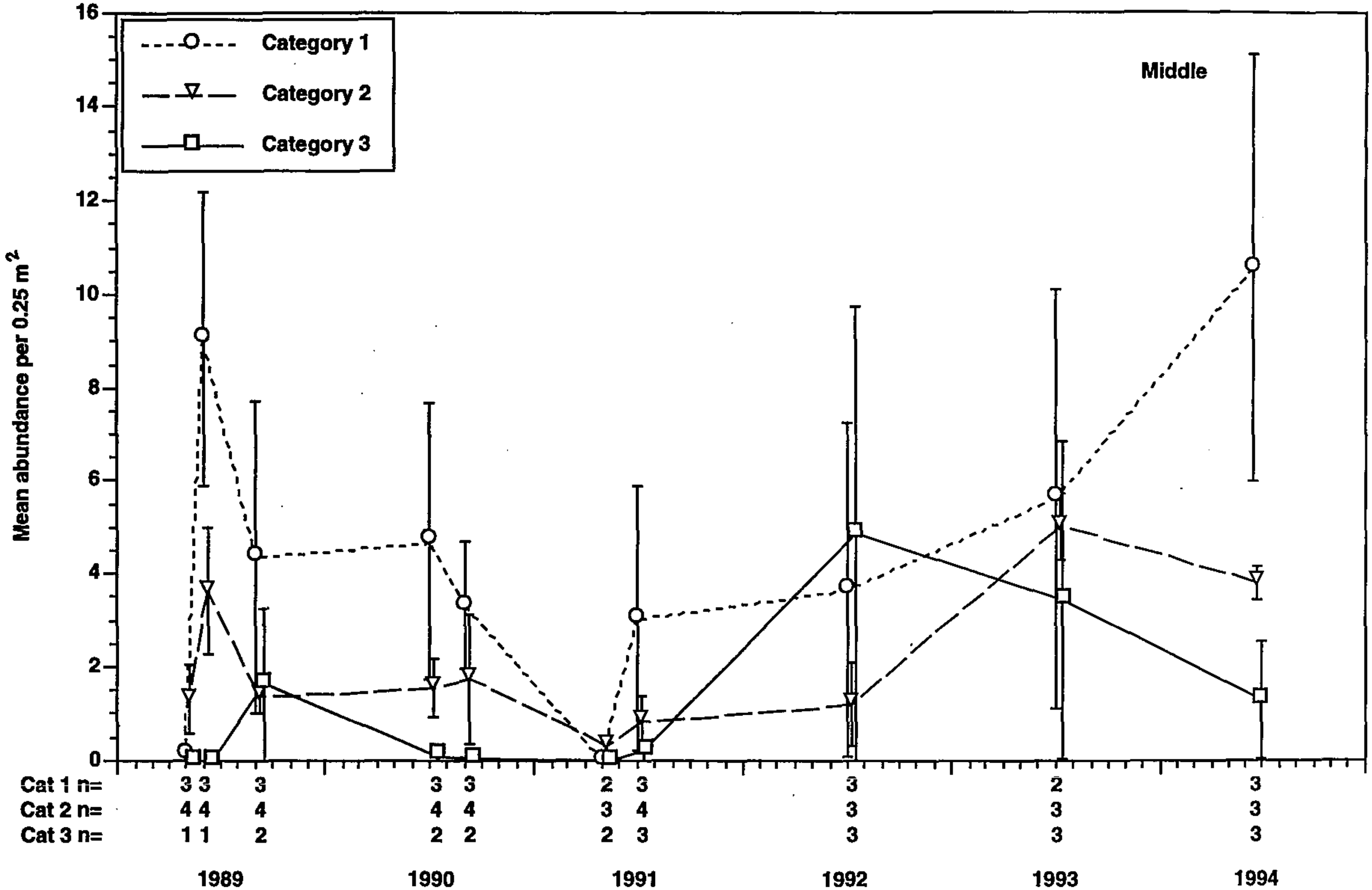



Figure 2-15 Mean abundance (±1 SE) of *Nucella* from middle rocky stations, by category 1989-94.

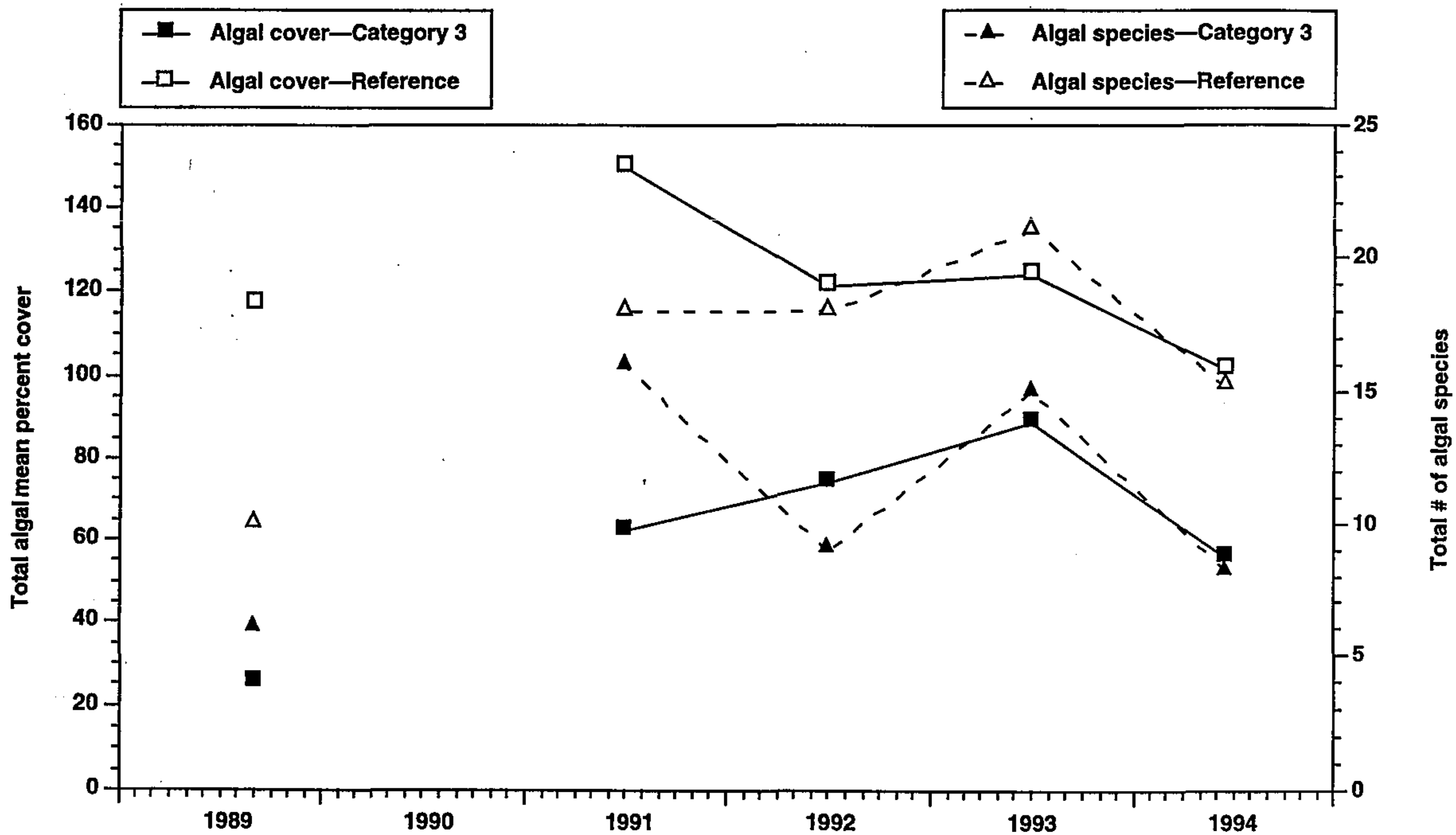



**Figure 2-16** **Mean percent total algal cover and total number of algal species/site from the Northwest Bay West Arm middle rocky stations, 1989-94.**

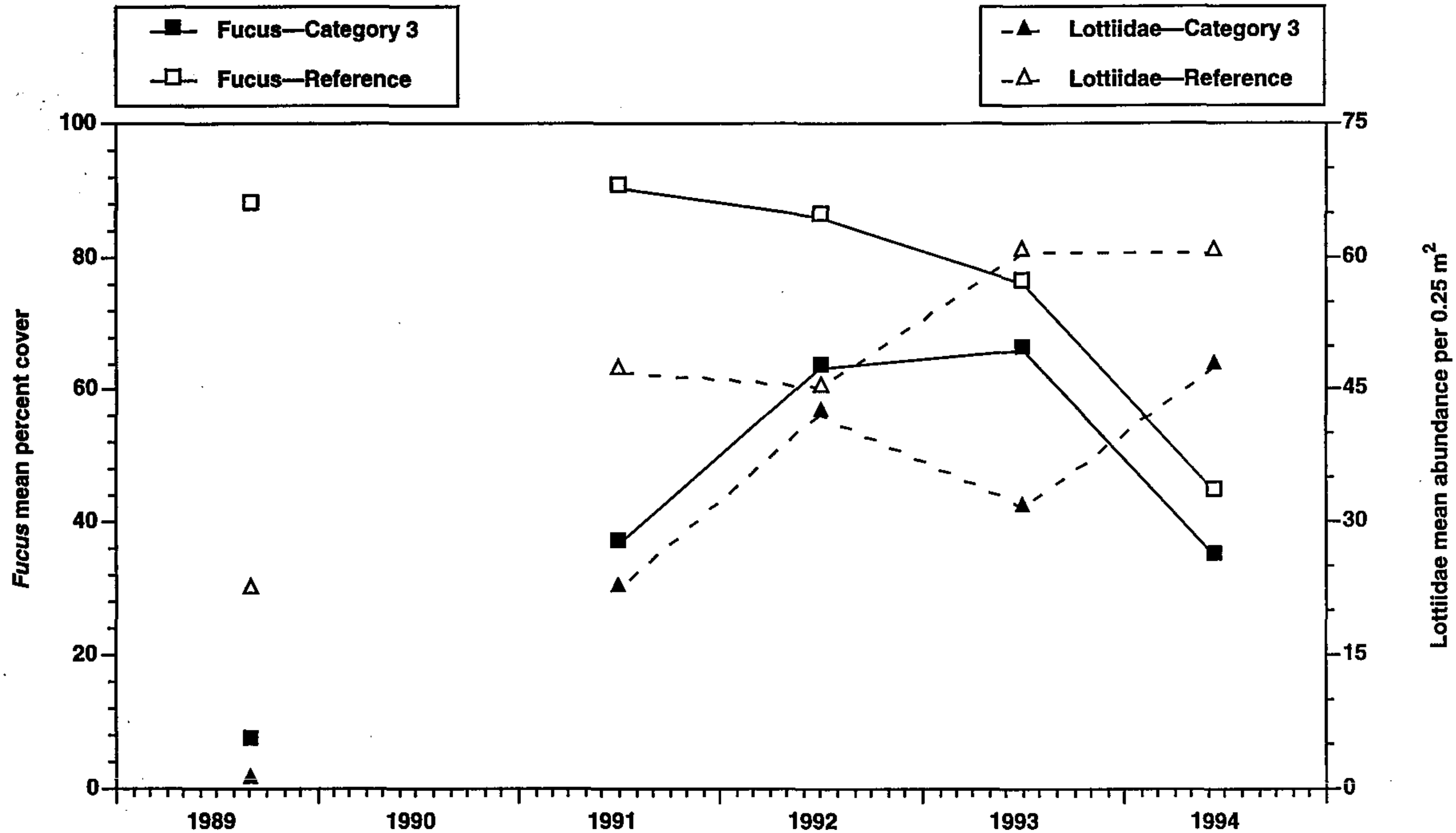



**Figure 2-17** **Mean percent cover of *Fucus* and mean abundance of Lottiidae from the Northwest Bay West Arm middle rocky stations, 1989-94.**

The mean number of algal taxa at the reference station increased from 1989 through 1993, possibly showing some recovery from effects of oiling, but more probably associated with increasing taxonomic sophistication of the investigators (Figure 2-16). The number of algal taxa declined at the Category 3 station from 1991 to 1992, increased again in 1993, but declined in 1994. The difference in mean total number of algal taxa between the two stations had increased in 1992, a trend contrary to the recovery and probably the result of increased *Fucus* dominance that excluded some other species; in 1993 this difference diminished slightly and remained constant in 1994 (Figure 2-16).

The opportunistic red alga *Gloiopeltis furcata*, which was significantly more abundant at the more disturbed Category 3 station in 1991, declined steadily in abundance there and increased in abundance at the reference station such that cover in 1994 was greater at the reference station (Figure 2-18).

The cover of erect red algae (other than *Gloiopeltis*) peaked in 1991 at the reference station but otherwise has remained between 15 and 18 percent (Figure 2-18). At the Category 3 station, red algal cover was low following treatment and declined further until 1992. Cover has since increased to more than 7 percent in 1993 and 1994. The saccate red *Halosaccion glandiforme* first appeared at the Category 3 station in 1994 but remains significantly less abundant ($p < 0.01$) than at the reference station.

As with the plants, dominant animals showed continued recovery at the Category 3 stations between 1991 and 1994. Both mean number of individuals and mean number of taxa continued toward equalization between the two stations. Density of limpets at the two stations, which had converged in 1992 but diverged again in 1993, converged again in 1994 (Figure 2-17); density at the reference station was unchanged from its 1993 peak and density at the Category 3 station increased to a new peak. The opportunistic barnacle *S. balanoides* remained essentially absent following a precipitous decline from its 1991 peak at the Category 3 station (Figure 2-19). This sharp decline in barnacles at the Category 3 station has preceded a decline in numbers of the drill *Nucella lamellosa*. The large fluctuations in abundance of this predator and its principal prey at the hot-water washed station contrast sharply with the relative stability of these two species at the reference station where the drill probably targets alternative prey (Figure 2-19).

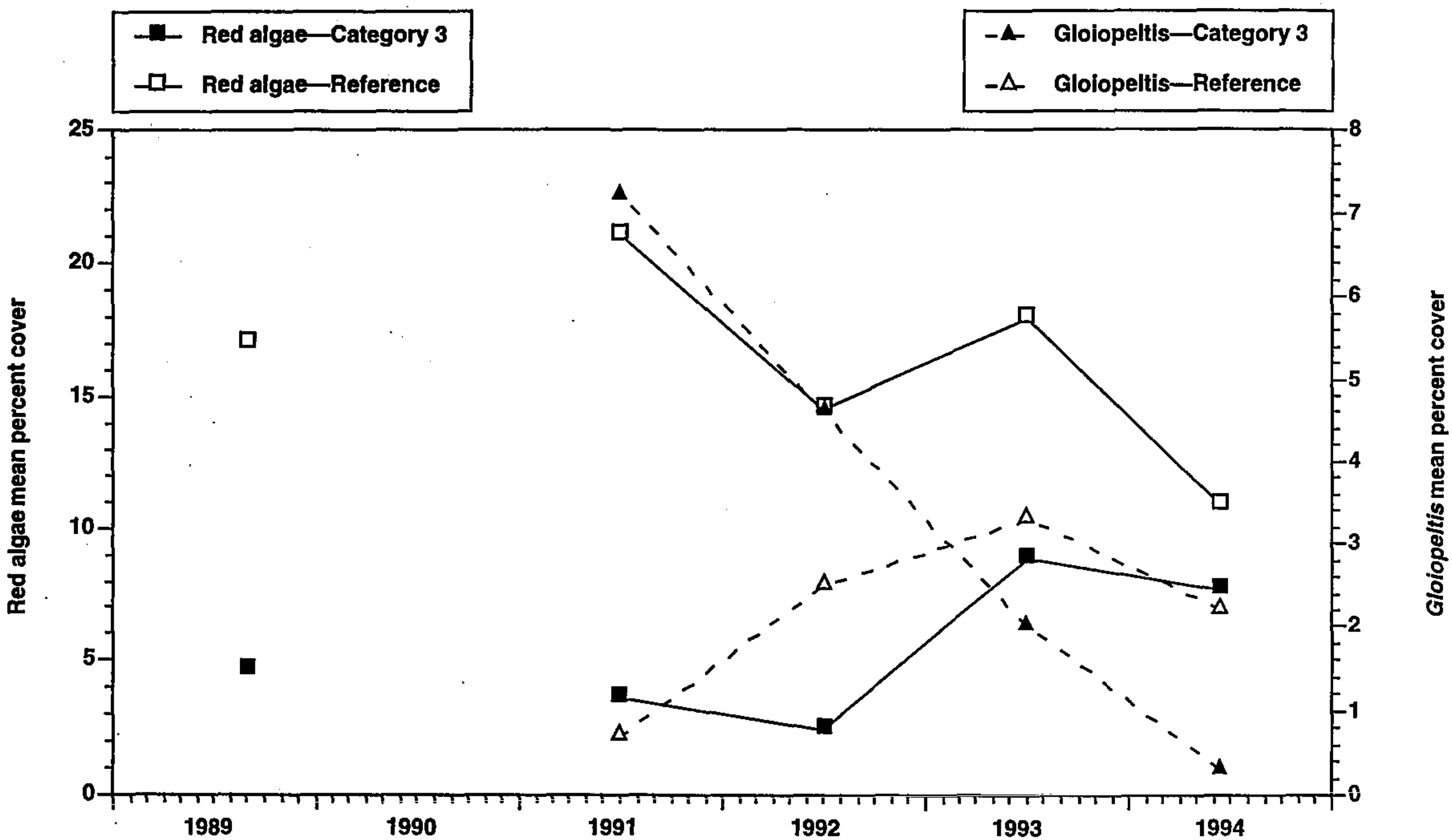



**Figure 2-18** **Mean percent cover of total erect red algae and *Gloiopeltis* from the Northwest Bay West Arm middle rocky stations, 1989-94.**

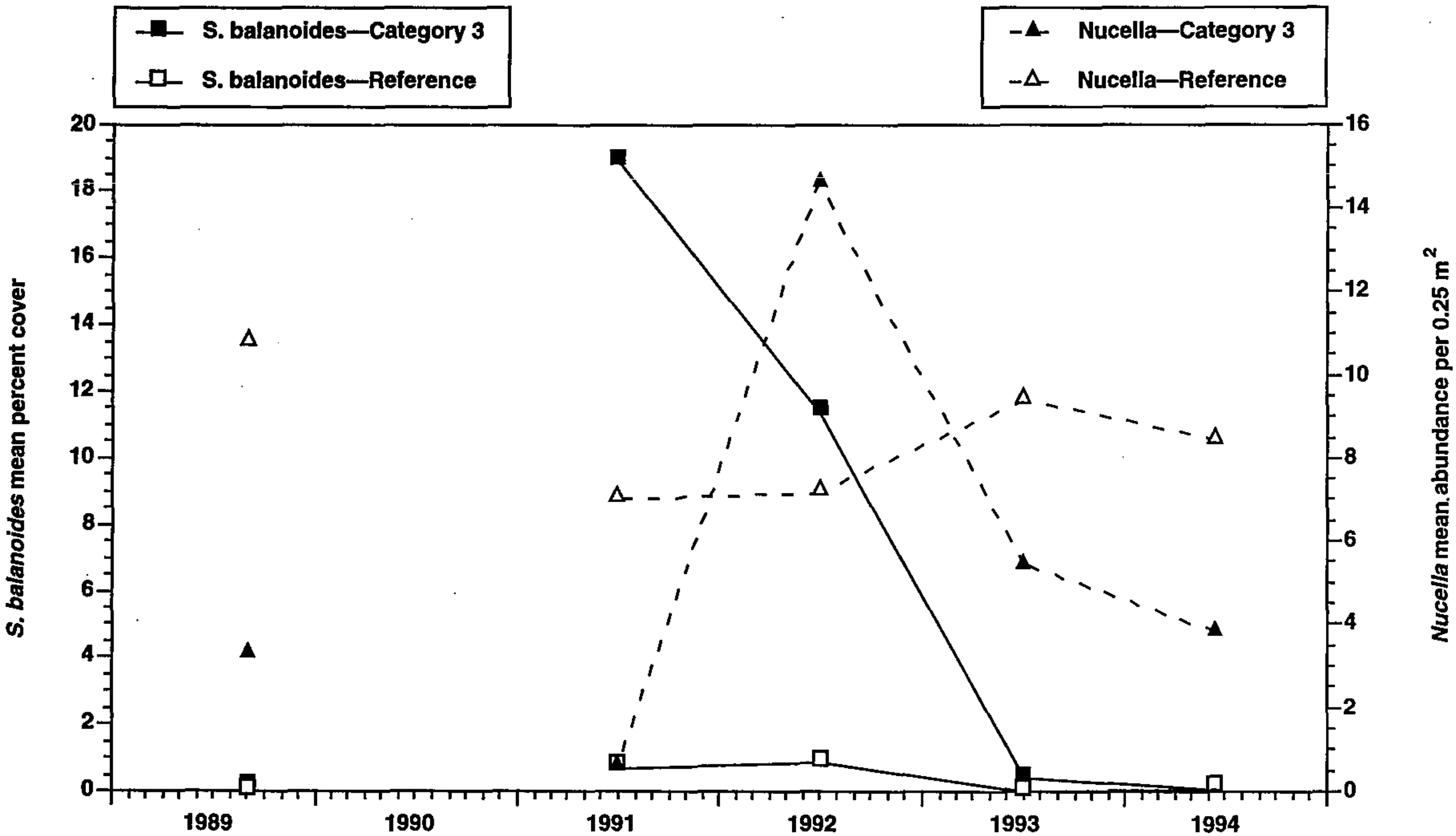



**Figure 2-19** Mean percent cover of ***Semibalanus balanoides*** and mean abundance of ***Nucella*** from the Northwest Bay West Arm middle rocky stations, 1989-94.

Abundances of both species of littorine snails at the reference site dropped sharply from peaks in 1992 to where there was no difference between the two stations in abundances of either species in 1993 (Figure 2-20); some rebound in numbers occurred in 1994. As in 1993, only one animal taxon showed a statistically significant difference between the two stations (Table 2-4): the pulmonate *Siphonaria thersites* has been significantly more abundant at the reference station since 1989, although numbers at the Category 3 station increased nearly fourfold from 1993.

Overall, the number and magnitude of significant differences between the two stations progressively declined from 1991 (when the number of quadrats was increased to five) until 1993 and remained unchanged in 1994 (Table 2-4). This trend indicates that normal biological controls are becoming reestablished at the Category 3 station, but full recovery may still be several years away. The degree to which remaining differences are the result of slight differences in wave exposure at the two sites is uncertain but will become clearer over time.

## Herring Bay-Omni-Barge Test Site

The Omni-Barge test site at the mouth of Herring Bay was revisited in 1994 and a series of quadrats were surveyed for the major community dominants (Table 2-5). The site was last surveyed in 1992. The beach was classified as a boulder/cobble beach in previous reports. However, the size and stability of the boulder substratum given the current wave regime has allowed the establishment of a *Fucus*-dominated community characteristic of a rocky habitat. The site was a test of the short-term effects of the hot-water wash on a heavily oiled site. Pre- and post-treatment surveys were taken at the site in July of 1989. By July 1992, a significant regrowth of *Fucus* had occurred. Barnacle coverage had greatly increased with a large percentage being a set of *S. balanoides*. Mussel cover remained below the pre-treatment levels.

By 1994 *Fucus* cover had decreased but remained above the 1989 pre-treatment cover estimate. This decrease in *Fucus* cover is consistent with the pattern seen at other Category 3 middle rocky stations (Figure 2-5). Barnacle cover had increased since 1992 in contrast to the decreased cover seen at the other Category 3 sites. Mussels increased as they had at most of the other Category 3 sites. The Omni-Barge site appears to be following some of the patterns seen in community dominants at other Category 3 rocky sites. The community appears to have regained its productivity even though it has not returned to its pre-oiling, pre-treatment structure.

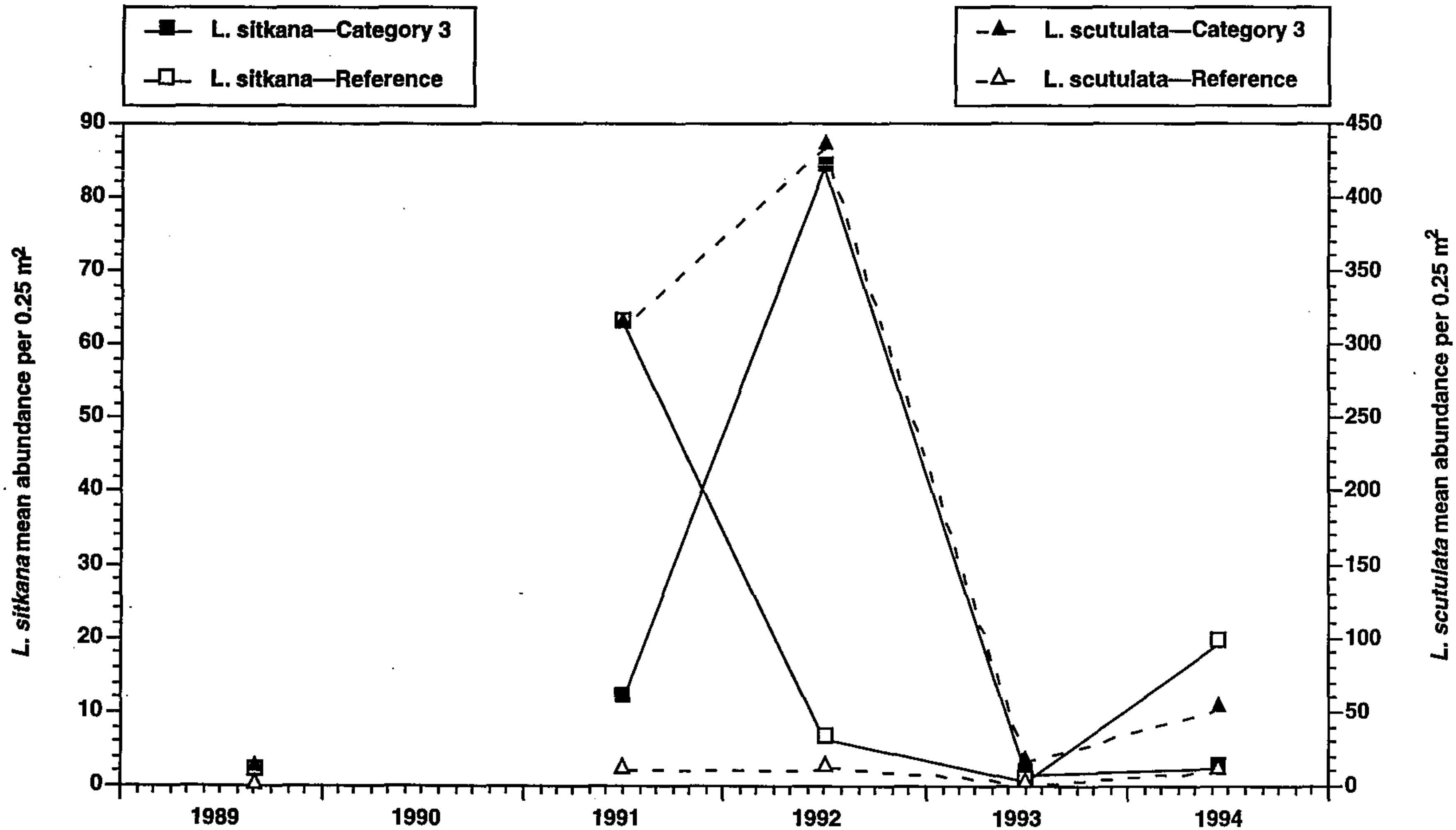



**Figure 2-20** **Mean abundance of *Littorina sitkana* and *Littorina scutulata* from the Northwest Bay West Arm middle rocky stations, 1989-94.**

## North Elrington Island Middle Rocky Stations

The middle rocky stations at Elrington East and Elrington West were revisited in 1994 to track the recovery of epifauna at a pair of sites with different treatment histories (Table 2-6). The two sites were located with similar tidal elevation and exposure. The total mean percent plant cover at the two sites was similar before treatment (Houghton et al. 1993b). The West site was treated using a high-pressure hot-water wash treatment (Omni Barge). The East site was washed using firehoses from a landing craft, a less severe treatment method.

Before the treatment, *Fucus* and encrusting non-coralline algae cover were similar at the two sites (Figure 2-21). Filamentous green and brown algae were more abundant at the East site. Abundance of littorines and limpets and percent cover of barnacles were different between the sites. The West (Table 2-6; Figure 2-22) site had greater numbers of littorines, limpets, and barnacles than did the East site. The East site had greater numbers of the hermit crab *Pagurus hirsutiusculus* than did the West.

Following initial treatment, total plant cover changed little at the East site (Figure 2-21) but decreased at the West site (Figure 2-22) apparently as a result of the more vigorous cleaning methods used. Barnacle cover and grazers (littorines and limpets) also decreased in abundance at the West site.

By 1992 total plant cover at the East site had increased to above pre-treatment levels. *Fucus* cover had more than doubled, but the encrusting non-coralline algae cover had decreased. Total plant cover at the West site had not returned to pre-treatment levels. *Fucus* cover had increased from the post-treatment values, but the encrusting non-coralline algae had continued its drop in cover to less than half of the post-treatment value.

Littorine populations remained depressed at the West site in 1992 but increased at the East site. Lottiidae showed a significant increase in numbers at the West site and a similar but less dramatic increase at the East site. Barnacle cover at the East side had recovered from the post-treatment depression by 1992 but still remained significantly below the cover found at the West site. The West site barnacle community had rebounded by 1992 until cover exceeded pre-treatment values. *Pagurus* spp. showed increased abundances at both sites in 1992. The population of *P. hirsutiusculus* at the East site increased over 400 percent.

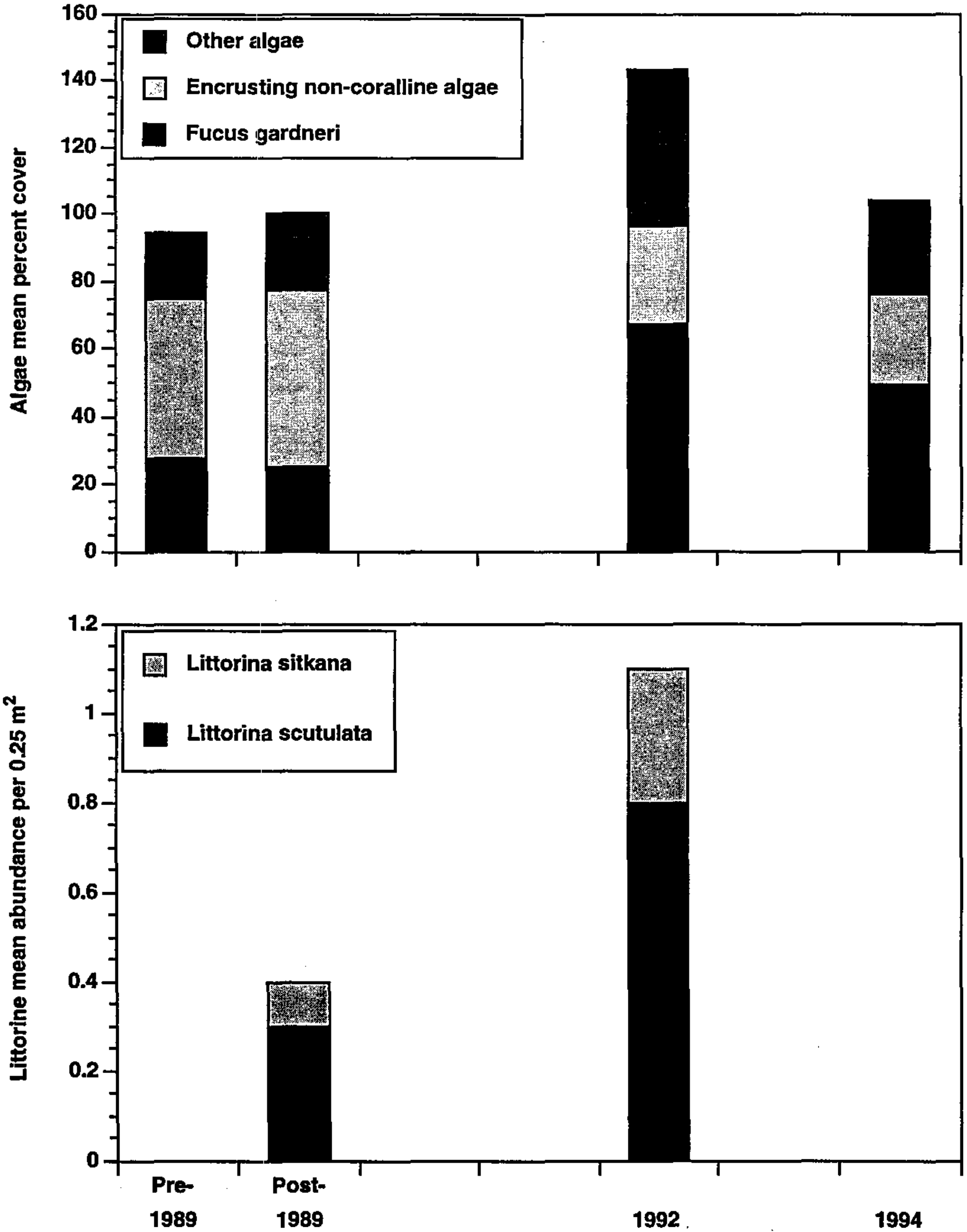



**Figure 2-21** **Mean percent cover or abundance of selected epibiota at North Elrington East middle rocky intertidal site, pre- and post-treatment 1989, 1992, and 1994.**

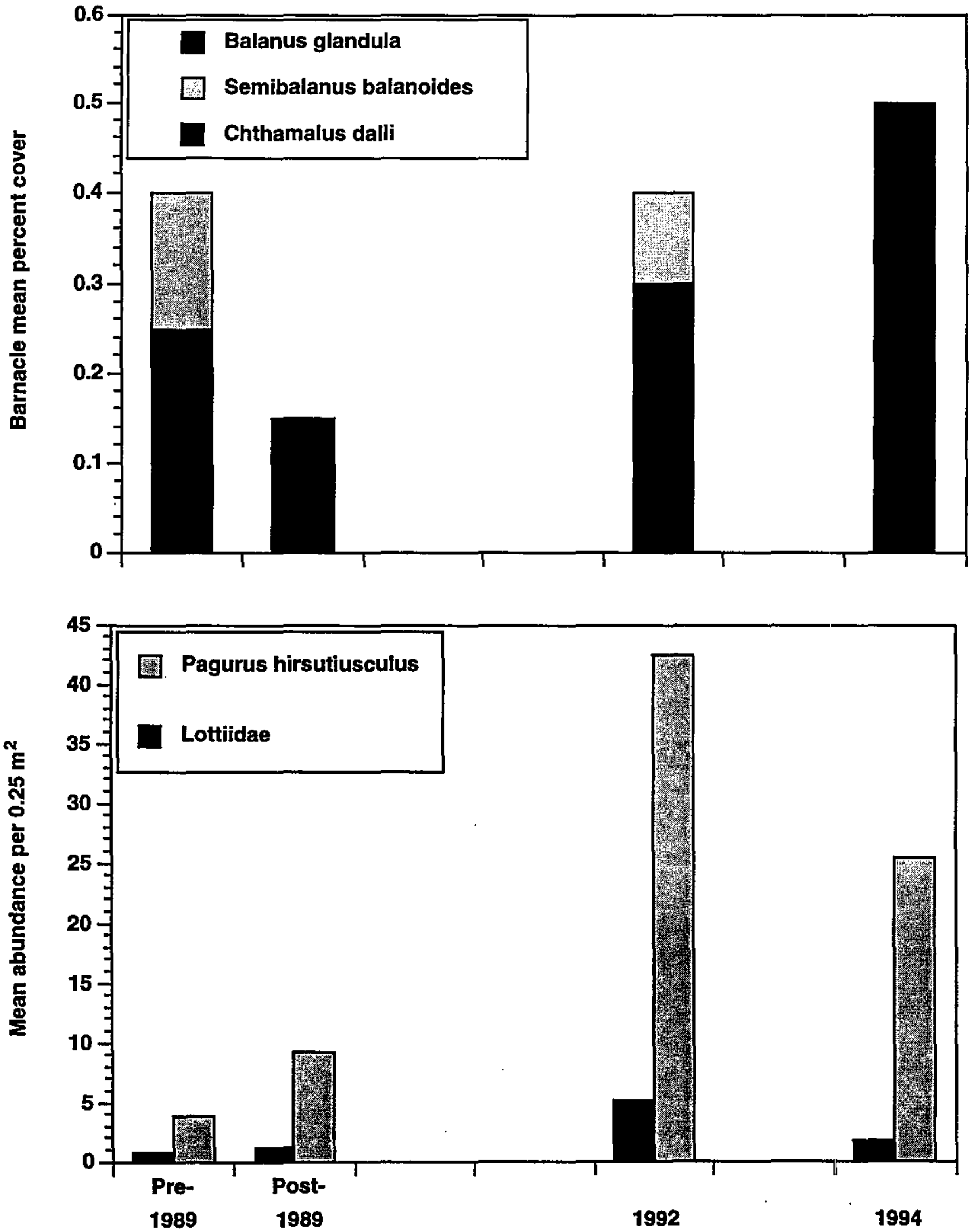



**Figure 2-21** (continued).

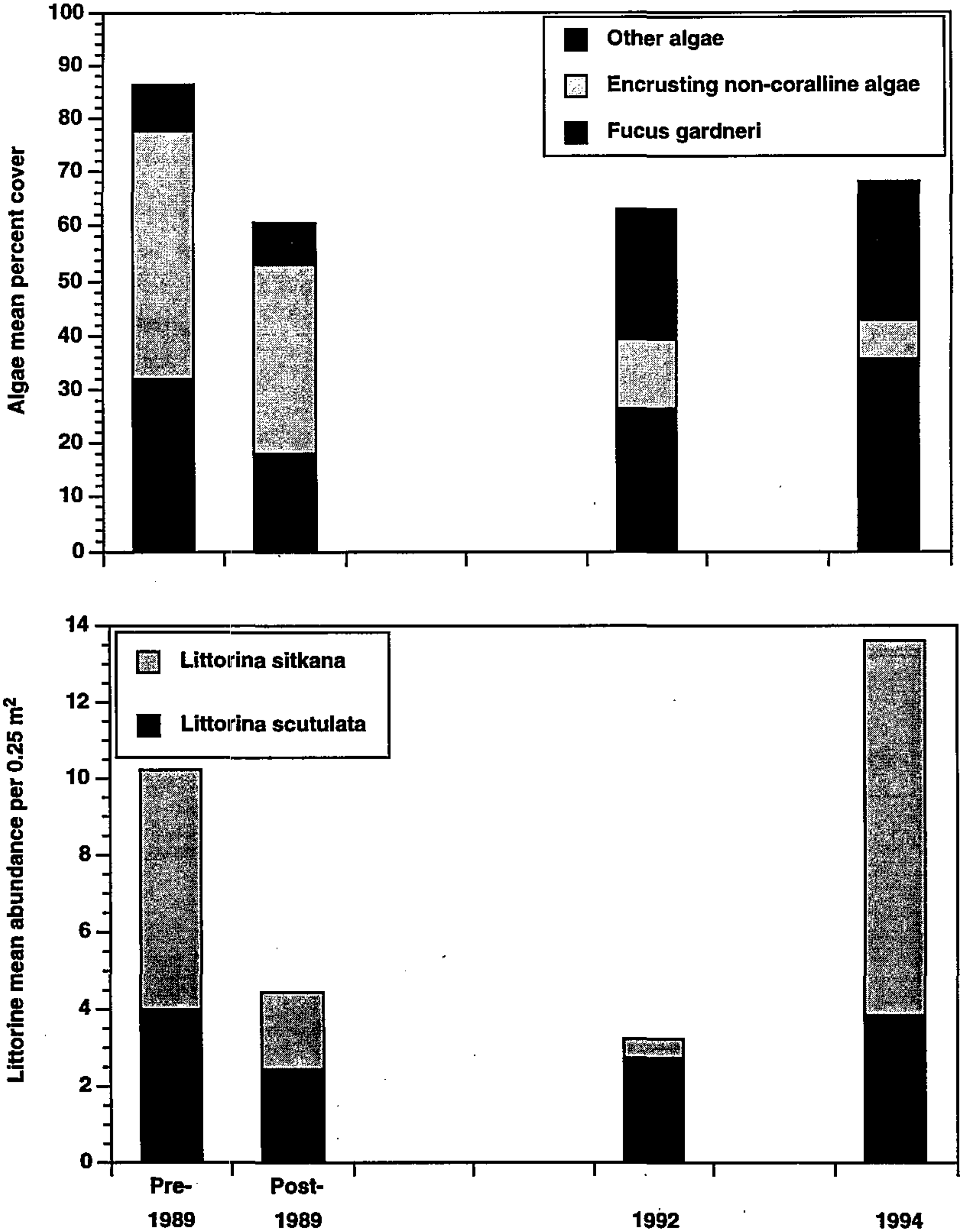



**Figure 2-22 Mean percent cover or abundance of selected epibiota at North Elrington West middle rocky intertidal site, pre- and post-treatment 1989, 1992, and 1994.**

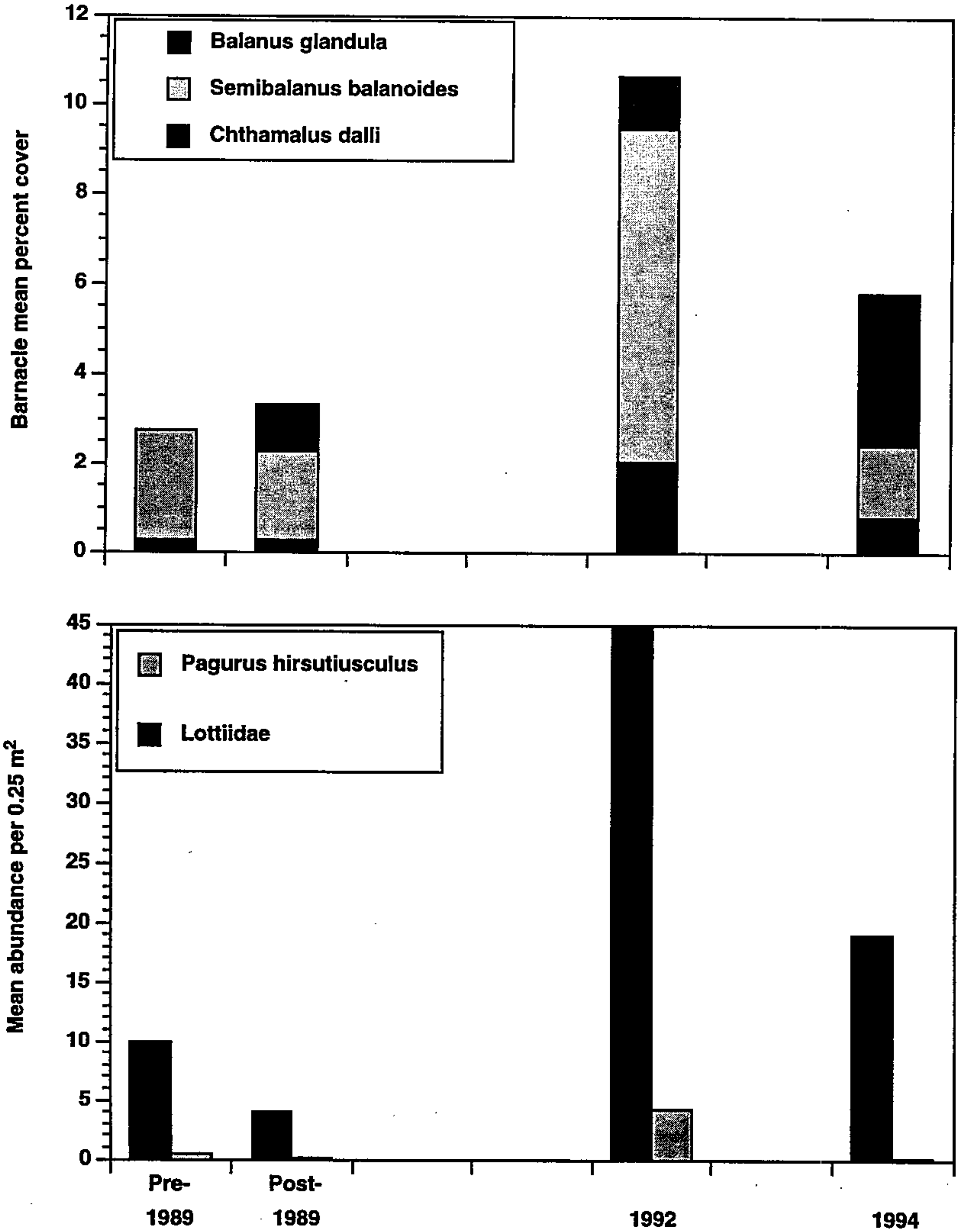



**Figure 2-22 (continued).**

Most populations that had shown significant growth or increases in numbers in 1992 had declined by 1994. An exception to this pattern was found in the abundance of *L. sitkana* at the West site. *L. sitkana* increased in 1994 to densities above the pre-treatment levels.

Lower Rocky Stations

The sampling of only a single Category 3 station (Northwest Bay Islet) limits the statistical power to test for category effects in the lower rocky intertidal. Statistical testing in 1994 was limited to t-tests between important epibiota at Category 1 and Category 2 sites (Table 2-7).

*Fucus* cover at Northwest Bay Islet lower station was higher in 1994 than at any of the Category 1 or 2 sites surveyed and remained well above its pre-treatment level (Figure 2-23; Appendix Table B-1-4). *Fucus* cover at the Category 2 sites and at the Category 3 site at Northwest Bay Islet decreased somewhat in 1994 (Figure 2-5), however, following the trend seen at the middle intertidal stations.

Coverage of the Rhodomelaceae/*Cryptosiphonia* complex remained significantly greater at the Category 2 sites than the Category 1 sites reflecting real differences among the sites (Table 2-7). Cover of these taxa and other erect red algae was greater at the Category 1 and 2 sites than at Northwest Bay Islet (Figure 2-24). This group of algae has remained severely depressed from its pre-treatment levels.

Fauna associated with the *Fucus* community, such as the littorines and Lottiidae, continued to be found at higher abundances at the Northwest Bay Islet site than at other lower stations (Table 2-7; Figures 2-25 and 2-26). Large fluctuations in littorine abundance that occurred through 1991 appear to have disappeared (Figure 2-25), but the abundance of limpets (Figure 2-26) remained unusually high for a lower rocky station. The drill *Searlesia dira*, which had been missing from the Northwest Bay Islet site since treatment in June 1989, was present in low abundance, but densities remained below the pre-treatment values.

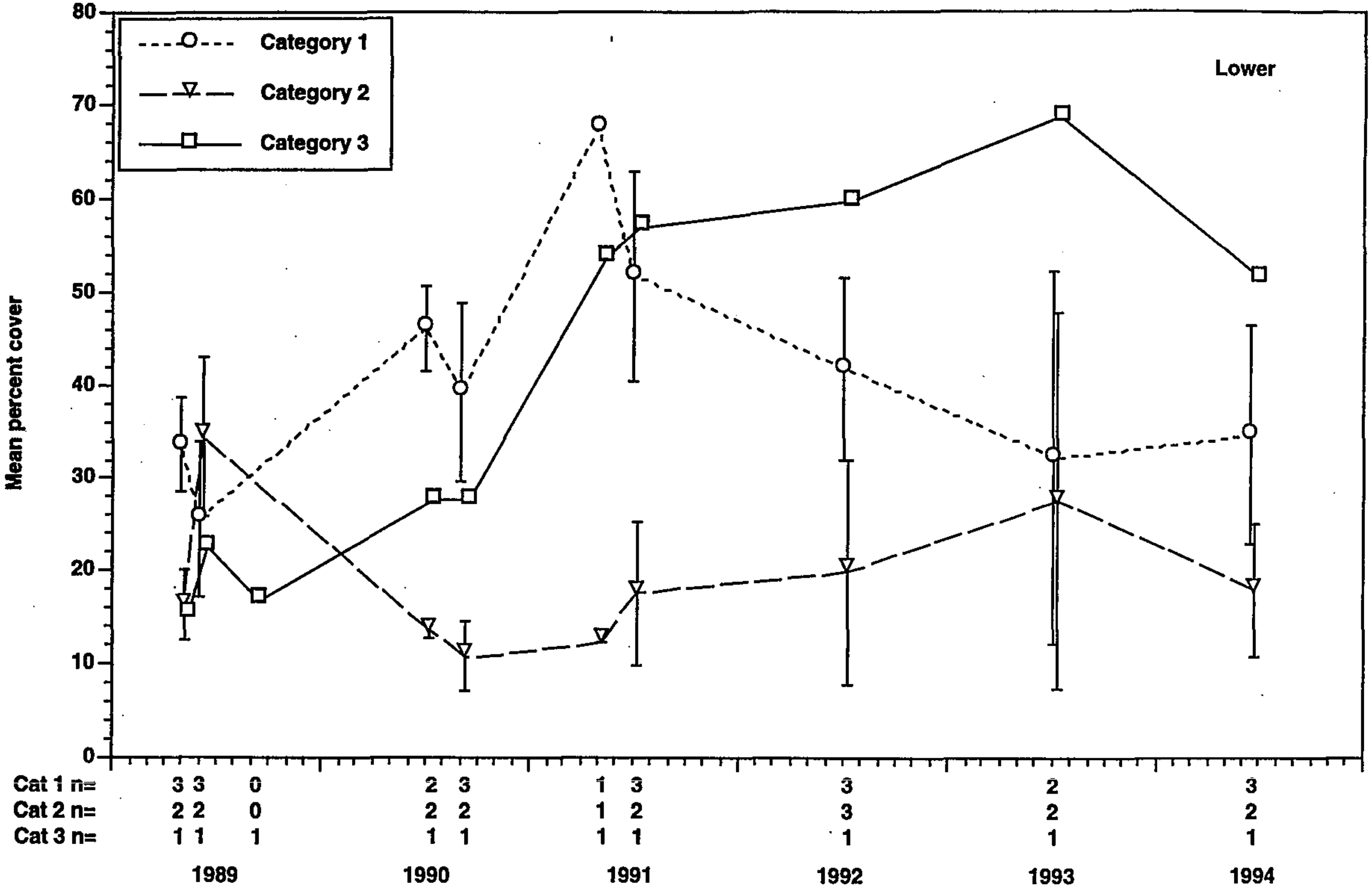



**Figure 2-23** Mean percent cover (±1 SE) of *Fucus* from lower rocky stations, by category 1989-94.

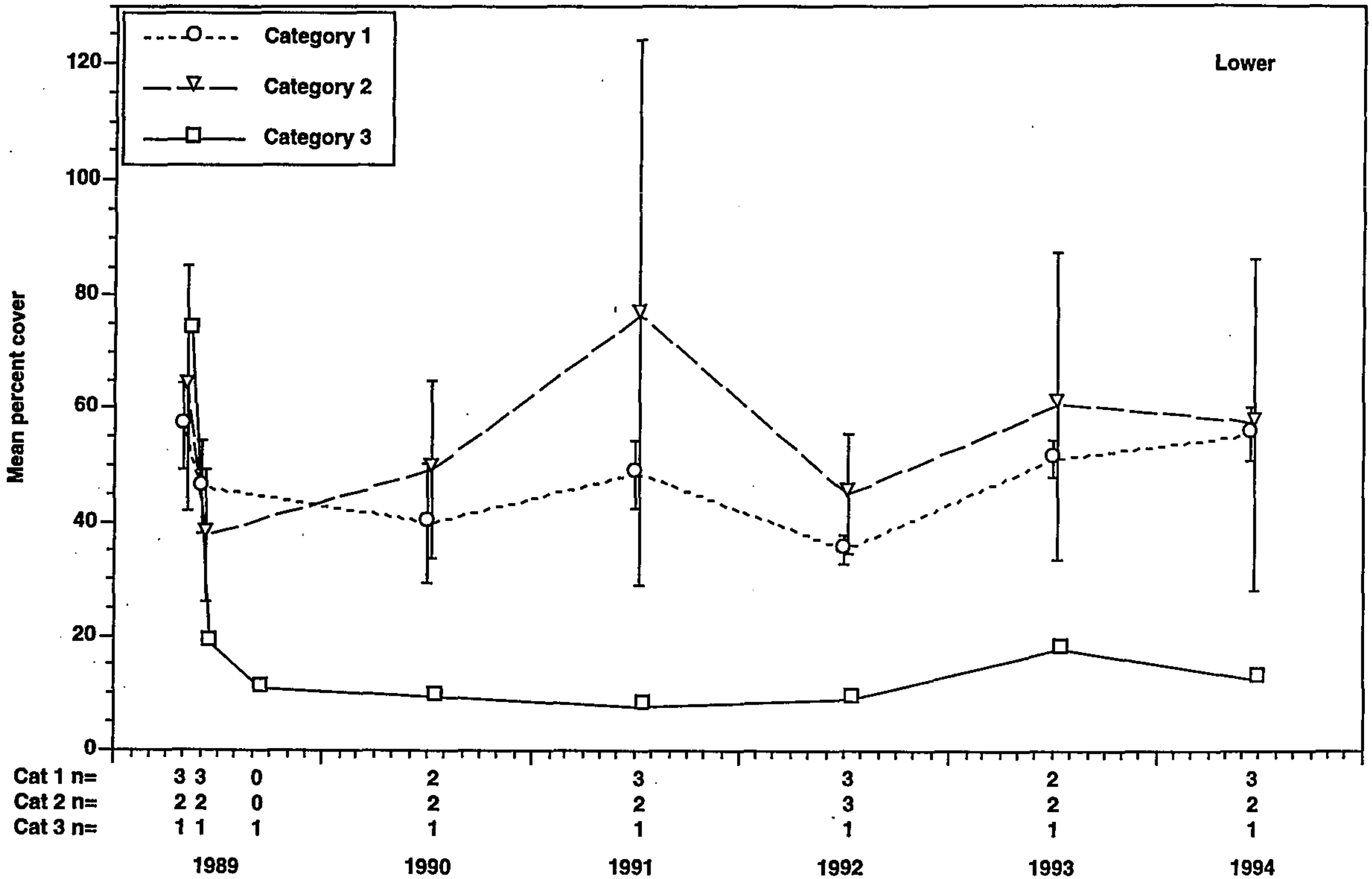



Figure 2-24 Mean percent cover (±1 SE) of total erect red algae from lower rocky stations, by category 1989-94.

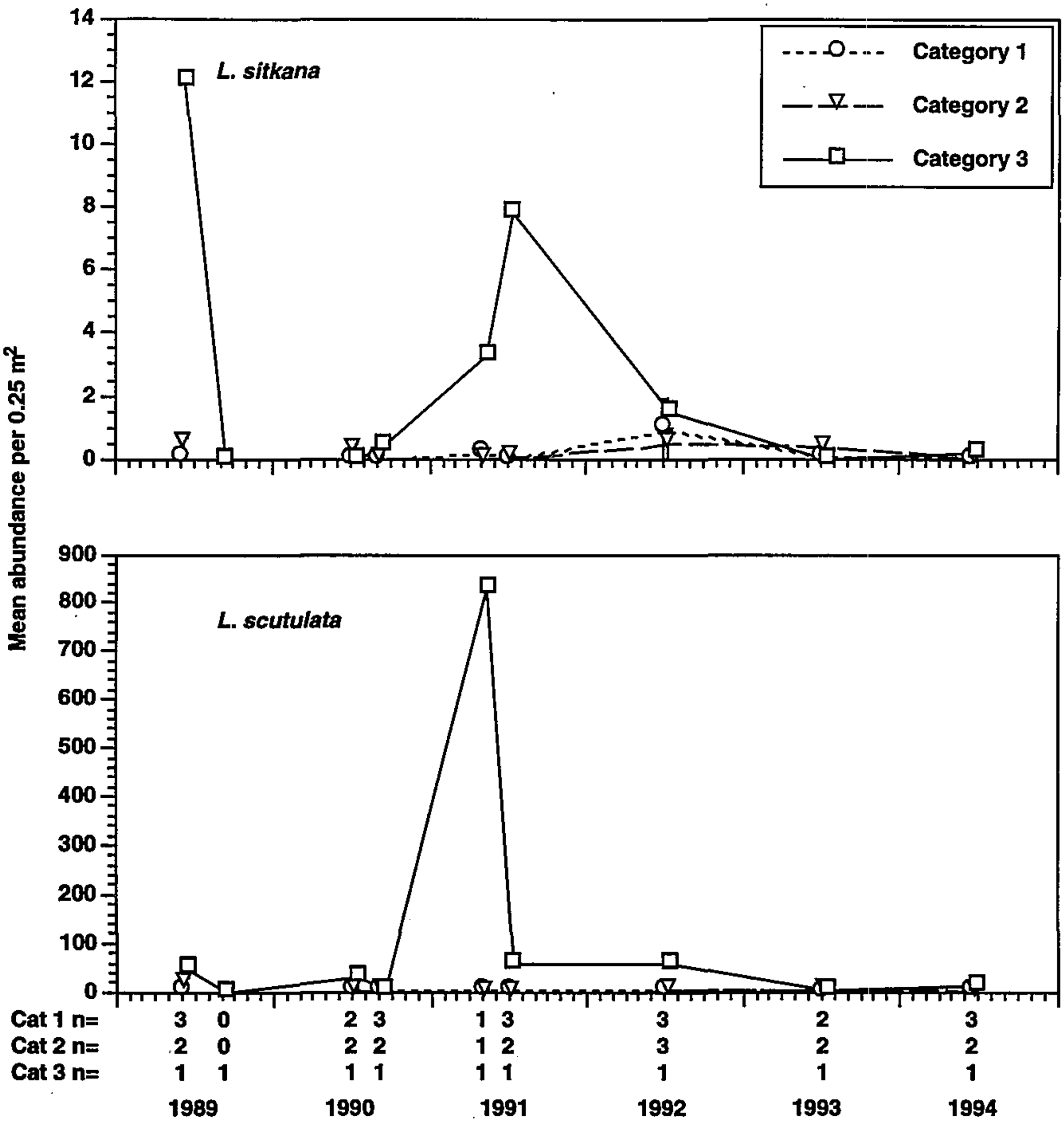



**Figure 2-25** **Mean abundance (± SE) of littorine snails from lower rocky stations, by category 1989-94.**

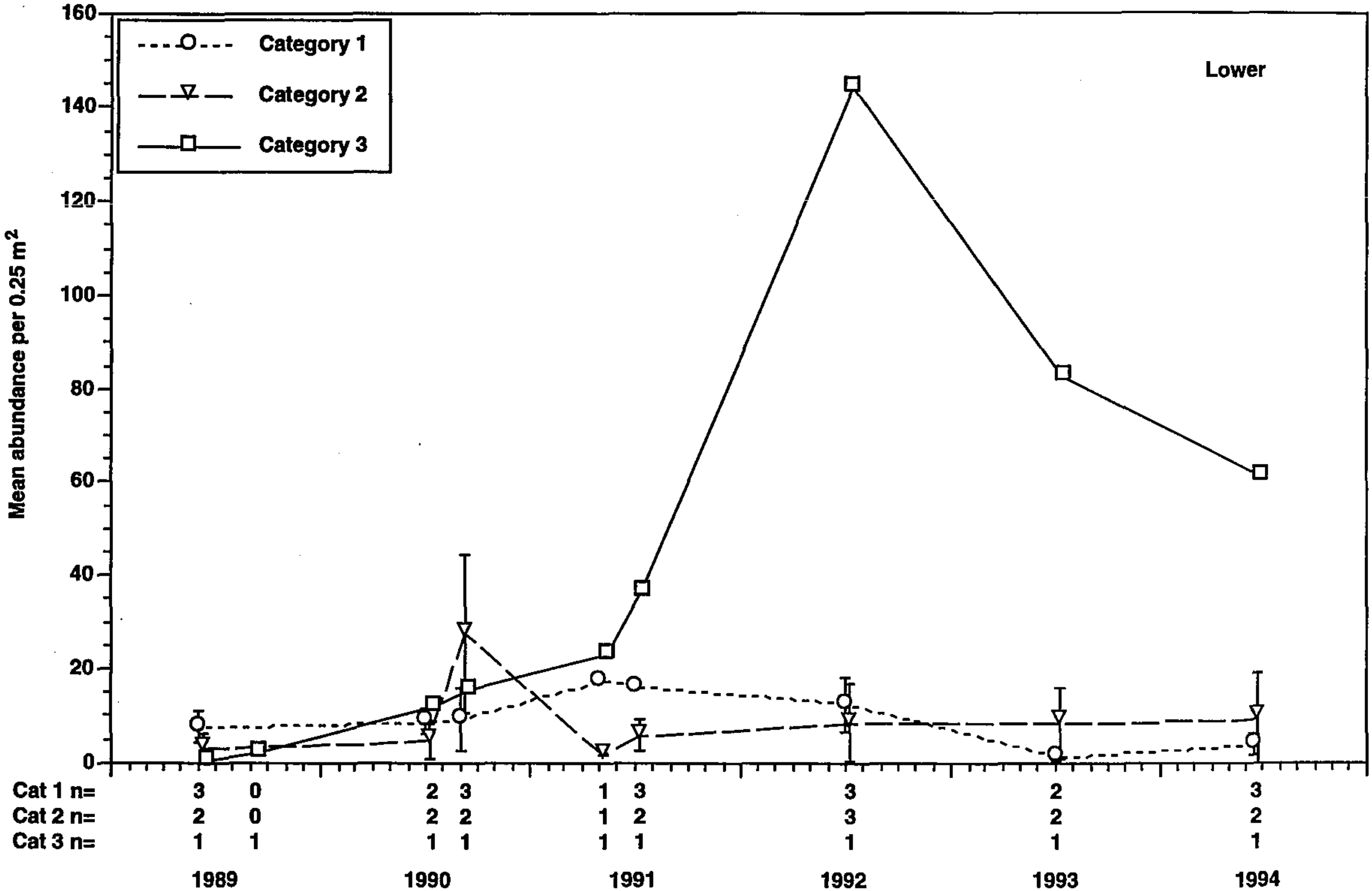



Figure 2-26 Mean abundance (±1 SE) of Lottiidae from lower rocky stations, by category 1989-94.

## Northwest Bay West Arm Mixed-Soft Stations

The middle and lower intertidal elevations at the Northwest Bay West Arm mixed-soft sites are classified as Category 3 sites. The sites, last surveyed in 1992, had been exposed to heavy or moderate oiling before treatment.

*Fucus* cover and total plant cover at the middle elevations decreased from the 1992 values (Figure 2-27). Cover of barnacles (Balanomorpha, all species) had rebounded from the sharp decline seen in 1992. Mussels continued their steady increase in cover. *L. scutulata* and *L. sitkana* decreased in abundance in 1994, but *L. scutulata* remained very abundant (359/0.25 $m^2$, Table 2-8). The number of limpets (Lottiidae) increased slightly at the middle station, but the density has not changed significantly since the large increase in 1991. Hermit crabs of the genus *Pagurus* decreased slightly.

At the lower elevation, *Fucus* cover increased slightly from 1992 values (Figure 2-28). Total plant cover increased over 600 percent, the result of increased cover of the filamentous green algae *Acrosiphonia* and *Cladophora* and the foliose green *Monostroma*. Cover of barnacles and mussels decreased slightly in 1994. The large population of *L. scutulata* (686/0.25 $m^2$) found in 1992 had decreased to under 300/0.25 $m^2$ in 1994. *L. sitkana* was found at very low densities in the lower intertidal during all years of the study. Lottiidae and *Pagurus* spp. increased to their highest abundance yet measured.

The wide range of fluctuation in abundance of most dominant taxa since 1990 at both elevations suggests that epibiota has not fully recovered at this site.

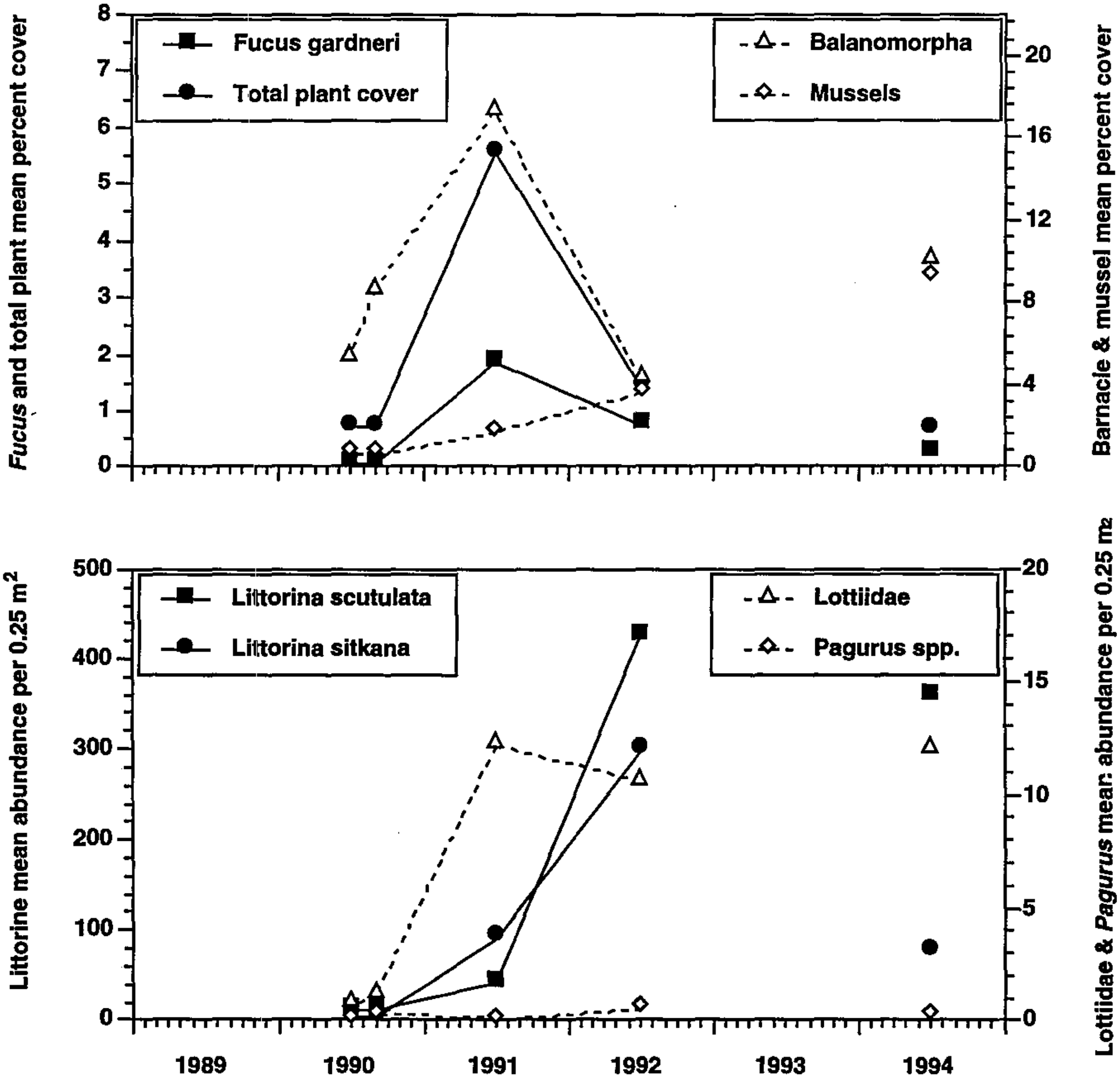



**Figure 2-27 Mean percent cover or abundance of selected epibiota at the Northwest Bay West Arm middle mixed-soft intertidal site, 1989-94.**

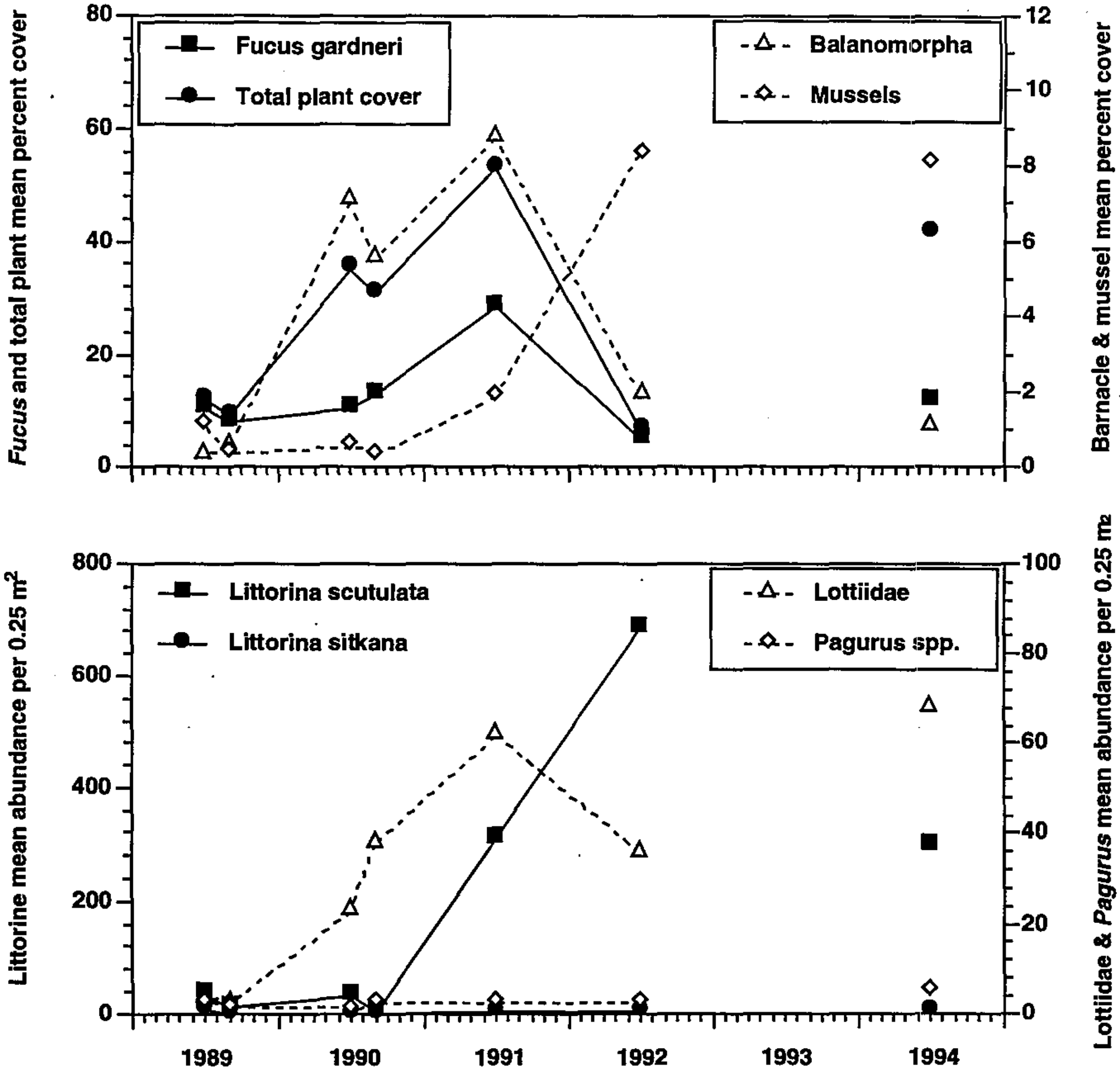



**Figure 2-28** **Mean percent cover or abundance of selected epibiota at the Northwest Bay West Arm lower mixed-soft intertidal site, 1989-94.**

# CHAPTER 3

# INTERTIDAL INFAUNA

## INTRODUCTION

Infauna was sampled at lower elevation stations at 12 mixed gravel, sand, and/or mud (mixed-soft) sites in June 1994. Detailed 1994 abundance data are provided in Appendix Table C-1. Limited analysis of the 1994 data is presented in this section along with temporal trends incorporating data from earlier years of the study (1989-93). The stations most consistently sampled throughout the study are included; in some analyses, the 1994 data from the Elrington West Category 3 lower station are also included. Analyses in this report include data from portions of the entire 1989 through 1994 database; for time series-analyses, emphasis has been placed on comparisons using the suite of lower stations most consistently sampled over time and on looking at trends over time at individual stations.

## METHODS

### *Field Methods*

Infauna was sampled with five randomly located 0.009-$m^2$-by-15-cm-deep cores taken adjacent to the permanently marked 0.25-$m^2$ quadrat locations used in earlier years to sample epibiota (Chapter 2). A different position relative to the quadrat was sampled in each successive sampling trip to avoid resampling the same location.

All five cores were field-sieved through a 1.0-mm screen, and residue was preserved in a 10 percent buffered formalin solution. A sixth sample was taken for grain size analysis, and a seventh sample was taken for analysis of TOC and TKN. These samples were frozen whole until laboratory analysis.

### *Laboratory Methods*

Samples were washed in the laboratory on a 0.5-mm screen to remove formalin and transferred to 70 percent ethanol. All infaunal animals were sorted from debris and identified to the lowest practicable taxon under a dissecting microscope. All sorting and taxonomy were done in the laboratories of Pentec Environmental, Inc. For quality control, 20 percent of each sample was re-sorted. Problematic species were identified by regional specialists (Ms. Sandy Lipovsky, Columbia Science, Royston, BC, Canada and Mr. Jeff Cordell, University of Washington, Seattle, Washington, Crustacea; Mr. Gene Ruff, Ruff Systematics, Puyallup, Washington, Polychaeta; Dr. Ron Shimek, RSEI, Wilsall, Montana, Mollusca).

### *Grain Size, TOC, and TKN Analyses*

Field-preserved whole sediment samples collected in June 1994 from 12 lower elevation mixed-soft stations were analyzed for grain size following the procedures of McNeil and Ahnell (1964). Sediments were wet-sieved through a standard sequence of nine screen sizes (12.5-mm to silt-clay < 63 microns). Each fraction was then placed into a displacement cylinder and displaced water was measured in a graduated cylinder.

Sediment samples from 12 lower elevation stations were frozen in the field and sent to Analytical Resources, Inc., for TOC and TKN analyses. TOC analysis was done on a Dohrmann DC-180 Carbon Analyzer on samples that were dried (70°C), ground, then sieved (120-micron mesh). Calibration, standardization, and spiking were conducted following manufacturers' directions using potassium phthalate (KHP). Samples were purged of inorganic carbon prior to analysis. TKN nitrogen analysis was done using methods as referenced by Plumb (1981).

### *Data Management and Statistical Analyses*

#### Summary of Taxon Deletions and Consolidations Employed for Analysis of the Infaunal Data

To produce tables for consistent analysis and comparison with previous surveys, the primary (raw) infaunal database was revised considerably. The first step in the revision was to delete irrelevant taxa that are typically epifaunal; these included fish, bryozoans, and other taxa (e.g., *Mytilus, Nucella, Pagurus, Turtonia minuta*, several snail taxa, Spirorbidae, Serpulidae, insects, etc.) that, although sampled and in some cases very abundant, are not truly infaunal. These taxa were eliminated from the laboratory database and are not included in the archived infaunal database or in the data presentations in Appendix Table C-1.

The next step was to remove meiofaunal taxa not adequately sampled by the techniques employed in this study. These included all harpacticoid copepods, nematodes, oligochaetes, and ostracods, which are shown separately from the true macroinfaunal data in Appendix Table C-1. Although in some areas larger ostracods are a significant component of the infauna, ostracods seen in this study were all relatively small and would not have been consistently retained on our screens. Calculation of total abundance (N) of selected macroinfaunal organisms (those consistently retained on a 1.0-mm screen) was made on this data set and used in subsequent analyses.

If, within a higher taxon (e.g., a genus, family, or order) some individuals were only identified to this higher taxonomic level and others were identified to a lower level (e.g., species or family), those identified to the higher level were dropped from the database before calculations of species richness (S) and diversity (Shannon H'). Taxa that were dropped for calculation of species richness and diversity are indicated in Appendix Table C-1 with an asterisk (*). In contrast, if within a higher taxon no individuals were identified to any lower taxonomic level, the taxon was kept in the database used to calculate S and H'.

In 1989 ten replicates were taken rather than the five replicates taken in succeeding years. This change in design required an adjustment of the 1989 H', N, and S values to five replicates using a Monte Carlo mean estimator. Once the final 1994 values for H', N, and S were calculated, they were bootstrapped (Efrong and Gong 1983) to obtain mean estimates comparable to the 1989 values. The bootstrapping resulted in minimal changes to the indices.

## Inferential Statistics

Various statistical analyses were applied to quantitatively describe the data (H', N, and S) and evaluate the significance of the findings. Parametric and nonparametric tests were applied as appropriate to evaluate the significance of differences observed between station categories. In these tests, the mean of all subsamples (replicates) at a given station was used to represent each variable; thus, n equals the number of stations within that category where the variable in question was measured.

## Randomization Tests

Infaunal organisms were lumped into major taxonomic groups (e.g., Polychaeta, Bivalvia, etc.) for randomization tests (see Chapter 2) of each taxonomic group to determine significant category effects (ANOVA) and differences between treatment categories (t-tests). Similar procedures were used (without lumping) to compare H', N, and S. Only two-tailed t-test results were considered in comparisons of Category 1 and 2 stations based on the observation that in the last several years there has been no consistent pattern of differences between these two categories. One-tailed randomization t-tests were used where trends were being followed from the previous year and specific differences were predicted, e.g., that number of species in Category 1 and 2 sites would exceed those in Category 3 sites. The randomization routines were adapted from algorithms published by Edgington (1987).

Multivariate Analyses

Principal component analyses (PCA) were run on log-transformed species abundance from the selected stations, 1989 to 1994. Rare species, those occurring at less than six stations or years, were dropped from the analysis. Using only the first two principal components, the station scores were plotted with successive years connected by lines. The resulting diagram was interpreted for association of categories, similarity in yearly trends, and correlations with various indices and environmental variables.

# RESULTS

## *Sediment Quality*

Grain-size, TKN, and TOC analyses from frozen samples were done for Category 1, Category 2, and Category 3 lower mixed-soft stations (n = 4, 4, 4). Volume displacement data for nine size fractions at each station are provided in Appendix Table A-3. Annual trends for TKN, TOC, and percent fines are presented in Table 3-1.

The data from 1991 to 1994 show suggestive trends among treatment categories; for example, Category 3 stations have tended to have consistently lower values of all three parameters than the other two site categories. However, there appear to be large year-to-year variations in values at individual sites. The yearly differences may be real, thus reflecting large natural variations, or they may be sampling errors resulting from unreplicated sampling at each site. Rather than emphasizing the differences in the current data set, we propose to collect replicate sediment samples in 1995 to assess natural site variations.

**Table 3-1. Sediment TKN, TOC, and percent fines (≤ 125 µ) from lower mixed-soft stations, summer data only, 1991-94.**

| | 1991 | 1992 | | | 1993 | | | 1994 | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Category and Location | % Fines | TKN | TOC | % Fines | TKN | TOC | % Fines | TKN | TOC | % Fines |
| **Category 1—Unoiled** | | | | | | | | | | |
| Bainbridge Bight | 21.0 | 282 | 19,800 | 33.9 | 586 | | 21.4 | 365 | 15,100 | 9.4 |
| Crab Bay | | 512 | 42,700 | 16.2 | 430 | 11,300 | 23.1 | 478 | 16.700 | 22.4 |
| Outside Bay | | 180 | 10,900 | 17.7 | 546 | 11,600 | 29.0 | 224 | 17,500 | 12.3 |
| Sheep Bay | | 316 | 15,200 | 22.4 | 470 | 8,420 | 32.3 | 518 | 10,900 | 20.0 |
| Category 1 mean | 21.0 | 323 | 22,150 | 22.5 | 508 | 10,440 | 26.5 | 396 | 15,050 | 16.0 |
| Standard deviation | 0.0 | 139 | 14,174 | 8.0 | 71 | 1,756 | 5.1 | 132 | 2,941 | 6.2 |
| **Category 2—OIled, untreated** | | | | | | | | | | |
| Block Island | 35.4 | 403 | 21,300 | 5.8 | 324 | 14,000 | 14.2 | 513 | 21,400 | 3.5 |
| Herring Bay | 38.2 | 199 | 16,600 | 22.8 | 502 | 11,400 | 26.0 | 499 | 18,000 | 16.5 |
| Mussel Beach South | 3.9 | 323 | 36,400 | 14.7 | 1,810 | 37,100 | 12.3 | 231 | 14,000 | 4.8 |
| Snug Harbor | 11.5 | 2,190 | 47,9229 | 11.5 | 3,410 | 46,200 | 20.2 | 287 | 18,900 | 8.8 |
| Category 2 mean | 22.2 | 779 | 30,557 | 13.7 | 1,512 | 27,175 | 18.2 | 383 | 18,075 | 8.4 |
| Standard deviation | 17.1 | 945 | 14,334 | 7.1 | 1,429 | 17,155 | 6.2 | 145 | 3,074 | 5.9 |
| **Category 3—Oiled, treated** | | | | | | | | | | |
| Northwest Bay West Arm | 2.1 | 56 | 9,440 | 2.3 | 122 | 7,330 | 3.6 | 99 | 6,690 | 4.9 |
| Shelter Bay | 9.2 | 122 | 6,120 | 8.1 | 156 | 9,490 | 4.4 | 119 | 7,380 | 1.3 |
| Sleepy Bay | 7.0 | 176 | 11,200 | 5.3 | 250 | 29,000 | 3.5 | 315 | 16,100 | 3.2 |
| Category 3 mean | 6.1 | 118 | 8,920 | 5.2 | 176 | 15,273 | 3.8 | 178 | 10,390 | 3.1 |
| Standard deviation | 3.6 | 60 | 2,580 | 2.9 | 66 | 11,937 | 0.5 | 119 | 4,947 | 1.8 |
| **Statistical tests** | | | | | | | | | | |
| Category effects ANOVA | 0.393 | 0.248 | 0.697 | 0.028 | 0.260 | 0.669 | 0.002 | 0.136 | 0.692 | 0.034 |
| t-tests (2-tail) | | | | | | | | | | |
| 1 vs. 2 | 1.000 | | | | | | | | | |
| 1 vs. 3 | 0.251 | 0.086 | 0.428 | 0.010 | 0.029 | 1.000 | 0.017 | 0.113 | 0.885 | 0.055 |
| 2 vs. 3 | 0.234 | 0.309 | 0.888 | 0.119 | 0.370 | 0.666 | 0.031 | 0.167 | 0.534 | 0.203 |

## Infaunal Communities

Infaunal data from June 1994, lumped by major taxa, are presented in Table 3-2. Detailed abundance data are provided in Appendix Table C-1. The remainder of this chapter provides brief descriptions of the 1994 results in the context of previously reported data.

### *General Abundance of Major Infaunal Taxa*

On the basis of numerical abundance, the total infaunal component (excluding meiofauna) of the 1994 samples from lower mixed-soft stations at Category 1 and 2 stations was dominated by bivalves, crustaceans, gastropods, and polychaetes (Table 3-2). On average, polychaetes and gastropods were most abundant at Category 2 sites in 1994; whereas, polychaetes alone represented more than 50 percent of the abundance at Category 1 stations. At Category 3 lower stations, infauna was dominated by crustaceans, gastropods, and polychaetes.

The main question is whether abundances at Category 3 sites are still lagging behind Category 1 and 2 sites. Since there were no significant category effects in ANOVAs of major taxa abundance (Table 3-2) or in t-test comparisons of Category 1 versus Category 2 sites, the data from Category 1 and 2 sites were pooled for comparisons to Category 3 sites. Results from this comparison showed that significant differences remained for polychaetes, bivalves (including *Protothaca*), and for *Protothaca* alone.

### *Patterns in Community Attributes*

A total of 10,202 specimens representing 148 taxa were identified in macroinfaunal samples collected in Prince William Sound in June 1994 (Appendix Table C-1). The summary community indices for these samples are presented in two models: as the mean of the individual replicates from a site and as the pooled value of all replicates from a site (Table 3-3). The difference in these two models, particularly in species richness, represents the degree of heterogeneity or patchiness within the site.

Abundance varied substantially among cores at many sites and among sites. Mean number of infaunal specimens (N) in cores (no./0.009 $m^2$) ranged from 23.4 (Northwest Bay West Arm) to 192.5 (Herring Bay). Differences in N among categories were significant in ANOVA of all site categories ($p = 0.07$; Table 4-3) and in t-tests of Category 1 and 2 vs. 3 ($p = 0.004$).

**Table 3-2. Intertidal macroinfaunal abundance (no./0.009 $m^2$) from lower mixed-soft stations, June 1994.**

| | Category 1 | | Category 2 | | Category 3 | | | t-tests (p) | |
|---|---|---|---|---|---|---|---|---|---|
| **Lumped Taxa** | **Mean** | **SD** | **Mean** | **SD** | **Mean** | **SD** | **ANOVA** | **1 vs 2** | **1&2 vs 3** |
| Aplacophora | 0.00 | - | 0.10 | 0.02 | 0.00 | - | - | - | - |
| Bivalvia (including *Protothaca*) | 18.05 | 17.97 | 15.15 | 13.55 | 0.80 | 0.52 | 0.16 | 0.421 | 0.008 |
| *Protothaca staminea* | 2.70 | 1.85 | 3.75 | 3.79 | 0.20 | 0.28 | 0.15 | -0.334 | 0.004 |
| Crustacea | 12.80 | 14.44 | 11.05 | 7.18 | 14.40 | 10.41 | 0.91 | 0.429 | 0.658 |
| Echinodermata | 1.20 | 1.21 | 0.60 | 0.67 | 0.00 | - | - | - | - |
| Echiuridae | 0.00 | - | 0.10 | 0.12 | 0.00 | - | - - | - | - |
| Gastropoda | 11.80 | 13.54 | 58.45 | 86.54 | 6.75 | 12.31 | 0.22 | -0.174 | 0.144 |
| Platyhelminthes | 0.20 | 0.23 | 0.10 | 0.20 | 0.20 | 0.16 | - | - | - |
| Polychaeta | 44.25 | 60.50 | 41.25 | 23.23 | 9.10 | 5.00 | 0.37 | 0.499 | 0.014 |
| Priapulida | 0.05 | 0.10 | 0.00 | - | 0.00 | - | - | - | - |
| Sipunculida | 0.00 | - | 0.80 | 1.6 | 0.00 | - | - | - | - |
| | | | | | | | | | |
| Meiofauna taxa (no statistical analysis performed) | | | | | | | | | |
| Harpacticoida | 9.65 | 7.36 | 25.70 | 18.31 | 0.75 | 0.66 | | | |
| Nematoda | 32.05 | 18.51 | 41.50 | 39.92 | 10.40 | 2.64 | | | |
| Oligochaeta | 21.15 | 19.39 | 10.95 | 6.70 | 12.05 | 15.16 | | | |
| Ostracoda | 0.00 | - | 0.70 | 1.40 | 0.00 | | | | |
| | | | | | | | | | |
| Number of stations | 4 | | 4 | | 4 | | | | |

**Table 3-3. Infaunal diversity (H′), abundance (N), and species richness (S) as means of five replicates and pooled H′ and S at each lower mixed-soft station, June 1994.**

| Category and Location | Mean of five cores* | | | Pooled | |
|---|---|---|---|---|---|
| | H′ | N | S | H′ | S |
| Category 1—Unoiled | | | | | |
| Bainbridge Bight | 1.50 | 162.61 | 13.07 | 1.99 | 42 |
| Crab Bay | 1.25 | 41.48 | 6.45 | 1.63 | 27 |
| Outside Bay | 1.72 | 71.14 | 13.75 | 2.09 | 37 |
| Sheep Bay | 2.54 | 53.85 | 18.84 | 2.92 | 33 |
| Category 1 mean | 1.75 | 84.77 | 13.08 | 2.16 | 34.75 |
| Standard deviation | 0.56 | 53.41 | 5.09 | 0.55 | 6.34 |
| Category 2—Oiled, untreated | | | | | |
| Block Island | 2.12 | 62.25 | 13.02 | 2.67 | 31 |
| Herring Bay | 1.38 | 192.53 | 11.42 | 1.50 | 25 |
| Mussel Beach South | 2.00 | 147.87 | 18.98 | 2.39 | 31 |
| Snug Harbor | 1.60 | 54.90 | 9.40 | 1.92 | 24 |
| Category 2 mean | 1.78 | 114.39 | 13.21 | 2.14 | 27.75 |
| Standard deviation | 0.34 | 67.04 | 4.13 | 0.55 | 3.77 |
| Category 3—Oiled, treated | | | | | |
| Elrington Island West | 1.20 | 30.60 | 6.00 | 1.70 | 14 |
| Northwest Bay West Arm | 1.00 | 23.38 | 4.44 | 1.22 | 10 |
| Shelter Bay | 1.21 | 36.08 | 5.65 | 1.83 | 21 |
| Sleepy Bay | 1.675 | 46.81 | 8.80 | 2.06 | 30 |
| Category 3 mean | 1.27 | 31.72 | 6.22 | 1.70 | 18.75 |
| Standard deviation | 0.27 | 10.49 | 1.84 | 0.35 | 8.77 |
| Statistical tests | | | | | |
| Category effects ANOVA | 0.187 | 0.071 | 0.062 | 0.392 | 0.022 |
| t-tests | | | | | |
| 1 vs. 2 (2-tail) | 0.974 | 0.568 | 0.942 | 1.000 | 0.119 |
| 1 and 2 vs. 3 (1- tail) | 0.021 | 0.004 | 0.003 | 0.075 | 0.013 |

* The H′, N, and S values are bootstrapped for comparison with 1989 data.

Mean number of taxa per core (S) and pooled taxa per site varied substantially among sites and site categories (ANOVA $p = 0.06$ and 0.02, respectively; Table 3-3). Average number of species per core ranged from 4.4 (Northwest Bay West Arm) to 18.98 (Mussel Beach) and was significantly lower at Category 3 than at Category 1 and 2 sites ($p = 0.003$). In t-tests, the pooled number of taxa at all Category 1 and 2 lower stations was significantly greater than at Category 3 lower stations ($p = 0.013$; Table 3-3).

The mean of the macroinvertebrate species diversity (H') calculations for individual cores also varied among stations ranging from 1.0 (Northwest Bay West Arm) to 2.54 (Sheep Bay; Table 3-3). Species diversity did not vary significantly among treatment categories, however ($p = 0.187$). In t-tests, Category 1 and 2 sites had significantly greater diversity than did Category 3 sites, based on station means and on pooled values ($p = 0.021$ and 0.075, respectively).

In summary, treatment category averages for these community attributes were consistently highest in Category 1 and 2 and lowest in Category 3 sites (Table 3-3). Average abundance was three to four times higher (down from four to five times higher in 1993), numbers of taxa were still more than twice as high, and species diversity was nearly 40 percent higher at Category 1 and 2 sites than at Category 3 sites.

*Infaunal Recovery Patterns*

The 1994 infaunal data from lower mixed-soft stations continue to exhibit a strong pattern of dissimilarity from Category 1 and 2 sites, which support higher numbers of organisms, more taxa, and greater species diversity, versus the Category 3 sites, which generally display a more impoverished infaunal assemblage (Figure 3-1).

In general, the three community attribute parameters peaked in 1992 or 1993 at all three treatment categories. Species diversity values at Category 1 and 2 sites have been nearly identical since 1991 (Figure 3-1). In 1994 species diversity and richness declined at Category 1 and 2 sites but increased slightly at Category 3 sites. Total abundance of infauna dropped at Category 1 sites in 1994 but increased slightly at Category 2 and 3 sites. From these summary graphs, it appears that recovery at Category 3 sites is still very slow or perhaps has reached some plateau beyond which further recovery may be limited (Figure 3-1). However, the differences between the Category 1 and 2 means and the Category 3 means narrowed somewhat in 1994. Also, examination of data from 1994 Category 3 sites reveals that adding a fourth Category 3 site, Elrington Island, has statistically masked an encouraging increase in species and abundance at Sleepy Bay (see multivariate analysis, Figure 3-2).

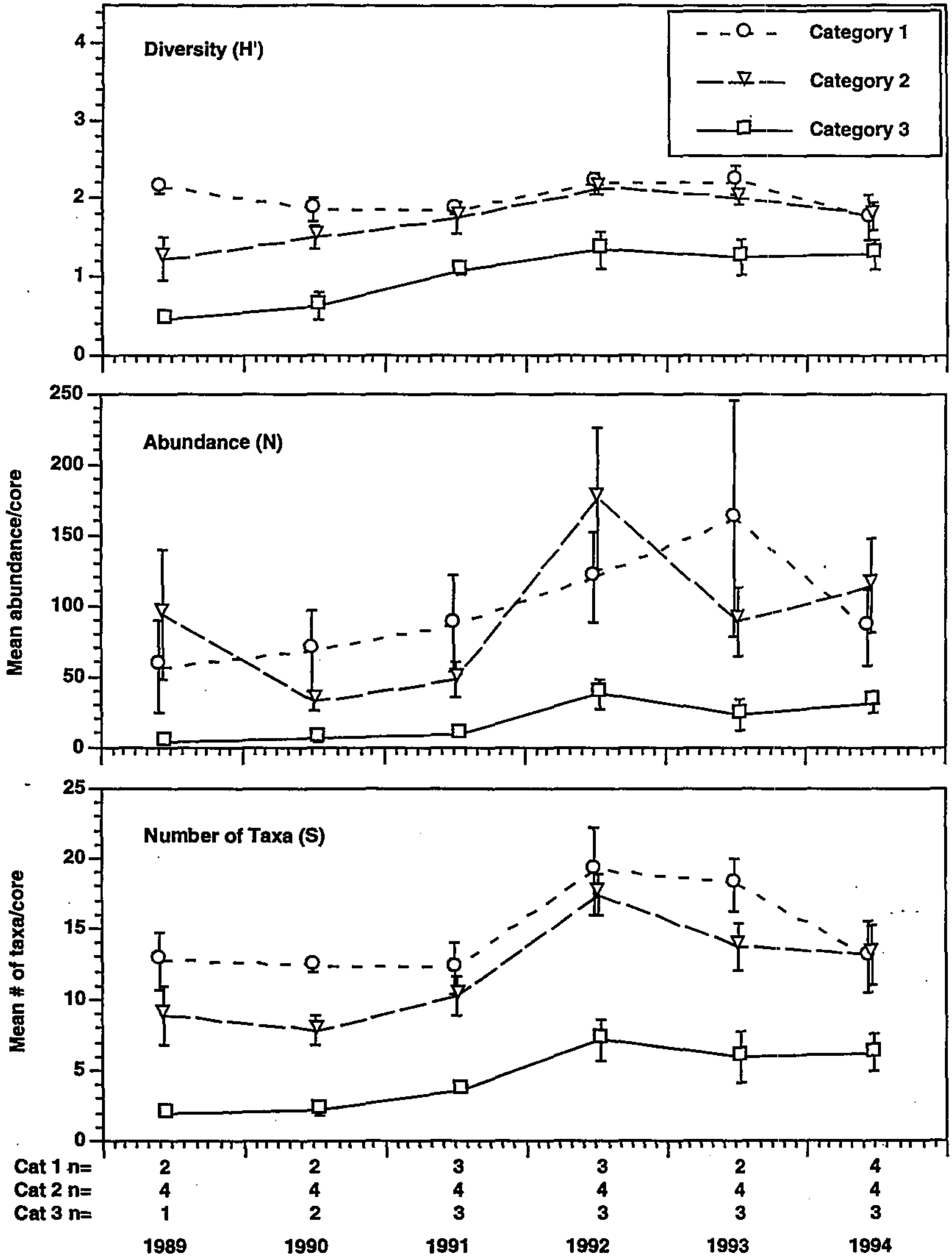



**Figure 3-1.** Selected attributes (±1 SE) of the macroinfaunal community from lower mixed-soft sites, 1989-94. Number of stations sampled (n) foreach category shown below axis.

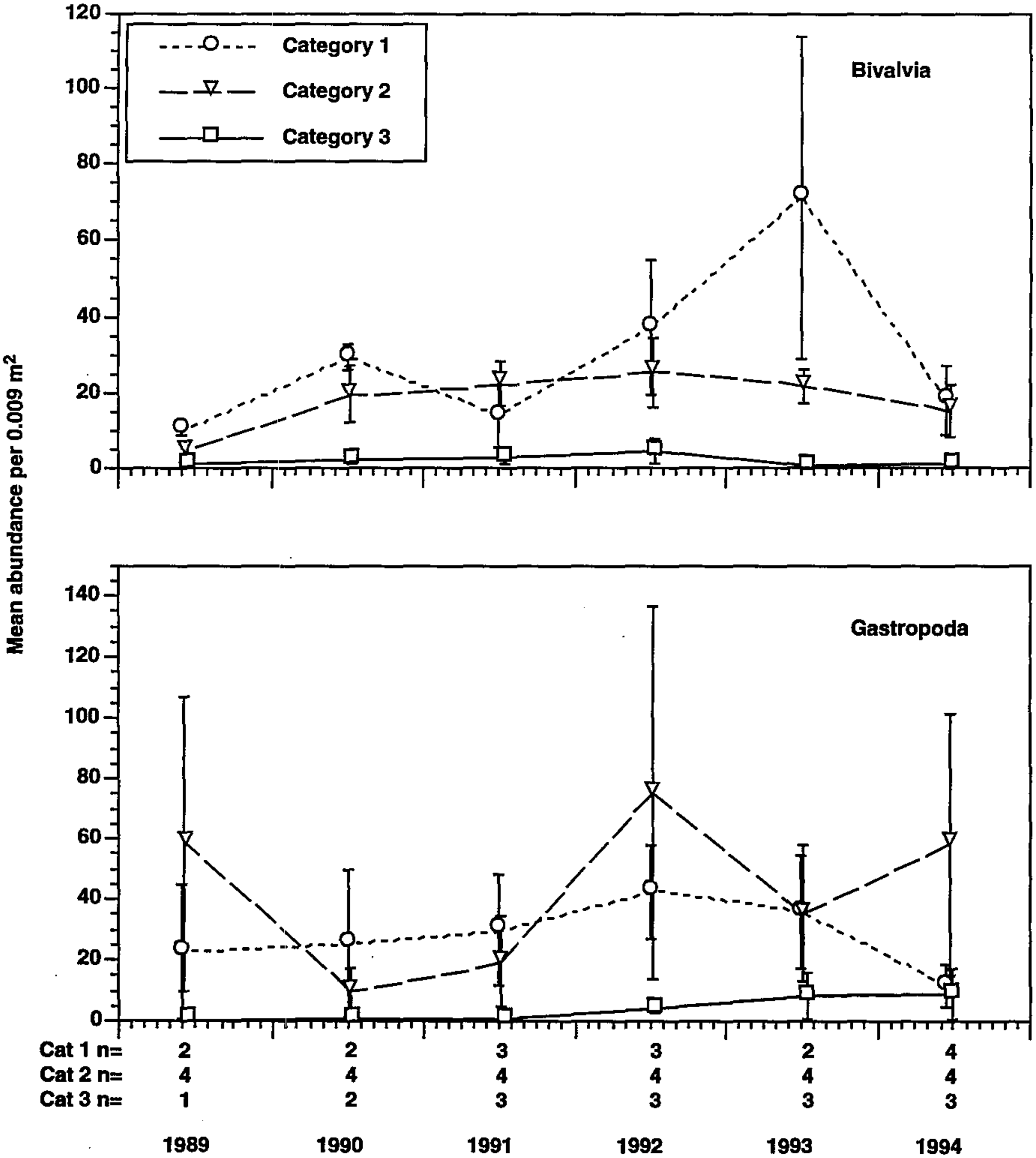



**Figure 3-2 Mean abundance (no./0.009 $m^2$ ±1 SE) of major taxonomic groups of infauna by treatment category, 1989-94.**

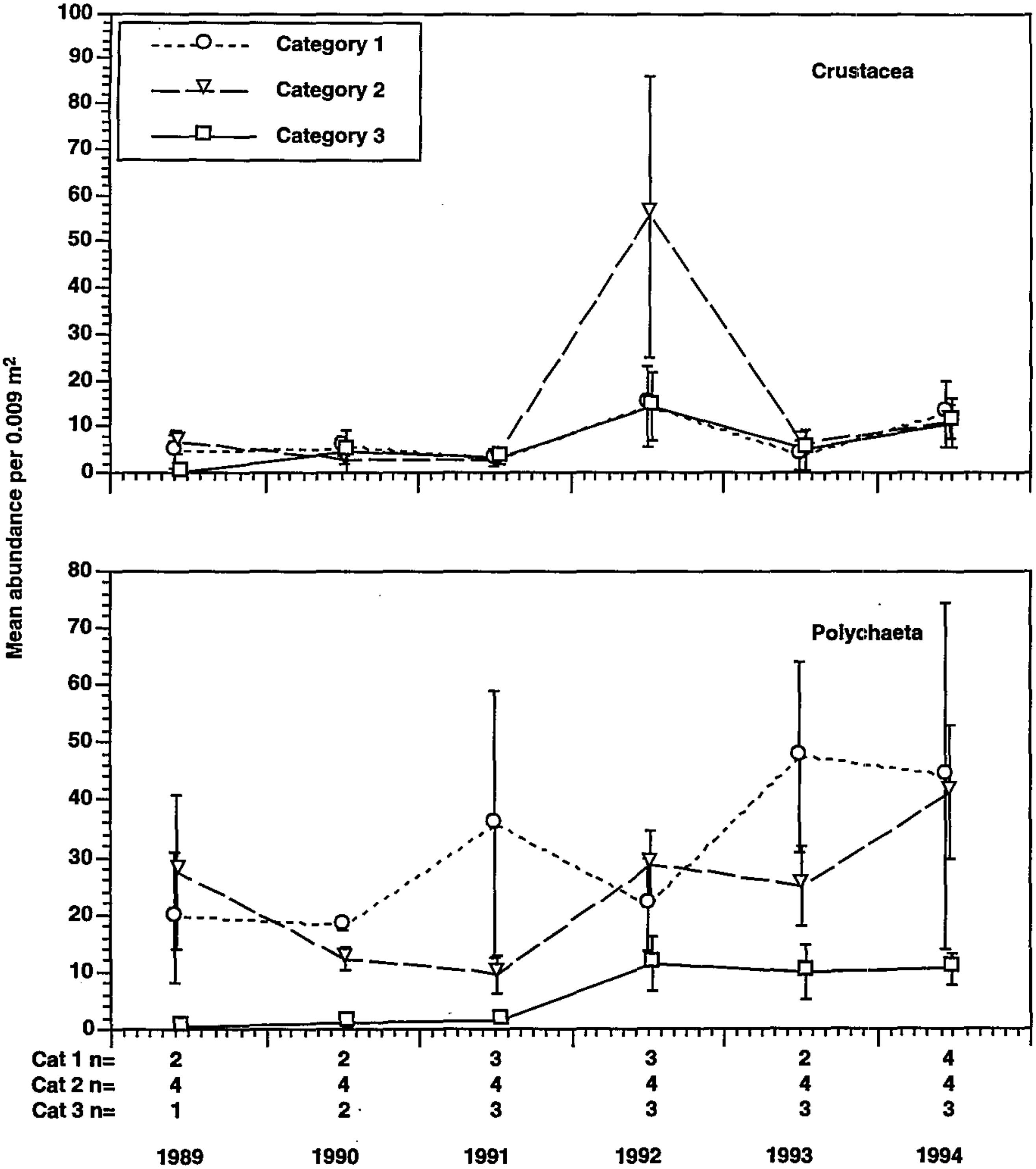



**Figure 3-2 (continued).**

Throughout the study, substantial differences in species composition have been observed among the categories: again Category 1 and 2 sites differed relatively little between themselves compared with Category 3 sites (Figures 3-3 and 3-4). From 1990 through 1993, clams, gastropods, and polychaetes dominated the infauna at Category 1 and 2 sites; whereas crustaceans were the clear dominants at Category 3 sites. The relative importance of polychaetes has increased at Category 3 sites since 1992 with an associated decline in relative importance of bivalves (Figure 3-4). In 1994 the Category 3 crustacean "bloom" rebounded from 21 percent to 35 percent. Meanwhile, bivalves dropped dramatically at Category 1 sites but remained at a low three percent at the Category 3 sites. In summary, significant differences remained in the relative contribution of the four major taxonomic groups between the Category 1 and 2 sites and the Category 3 sites in 1994.

*Infaunal Recovery Patterns - Multivariate Analysis*

In 1994 the PCA was modified slightly from previous years. Several extraneous sites were dropped, including the 1992 and 1993 samples from Bainbridge Bight, which were discovered to have been taken from a higher tide level than those in 1991 and 1994. The analysis still is based on the abundance of each species at each site (less those rare species noted previously).

The patterns of recovery seen in the 1994 data generally reflect those seen in 1993 with some notable differences. A strong positive correlation continued between the X axis placement and species richness, diversity, and total abundance; a strong negative correlation continued between the X axis placement and treatment category (Table 3-4; Figures 3-5 and 3-6). Weaker correlations were also seen with sediment PAH and percent gravel (negative), and with percent fines (positive).

On the PCA plot (Figure 3-6), there is a cluster of Category 1 and 2 sites in the lower right (Sheep, Mussel, Block, Outside) that appear to be hovering around or moving towards the same end-point. One of the encouraging changes this year is the movement of the Category 3 site, Sleepy Bay, towards this cluster. This movement, which is also reflected by increases in its H', N, and S values, is a good sign of recovery for Sleepy Bay. The other Category 3 sites are still clustered in the species-impoverished left quadrants and are likely far from recovery.

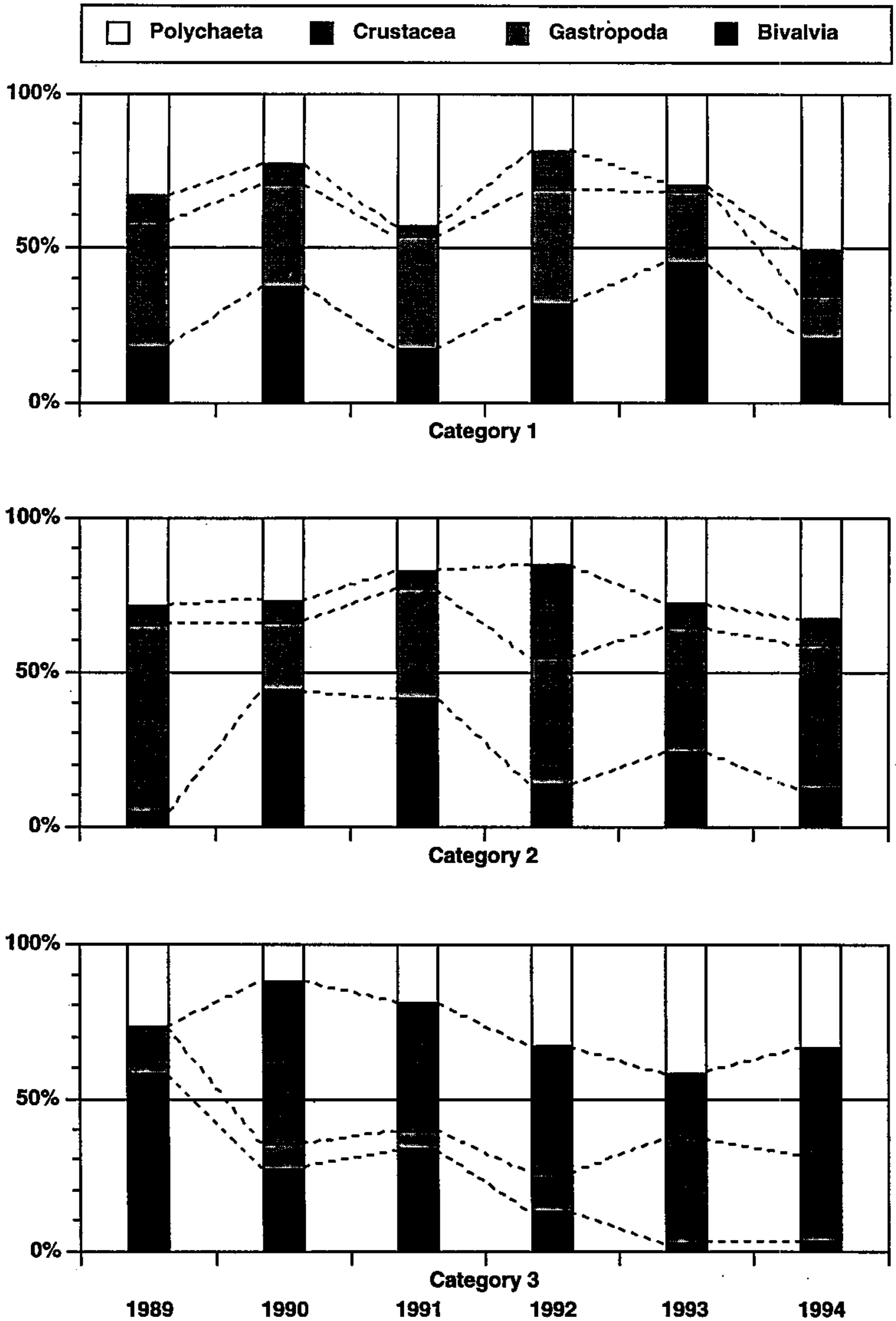



**Figure 3-3** **Relative abundance (% of total) of major taxonomic groups by treatment category, 1989-94.**

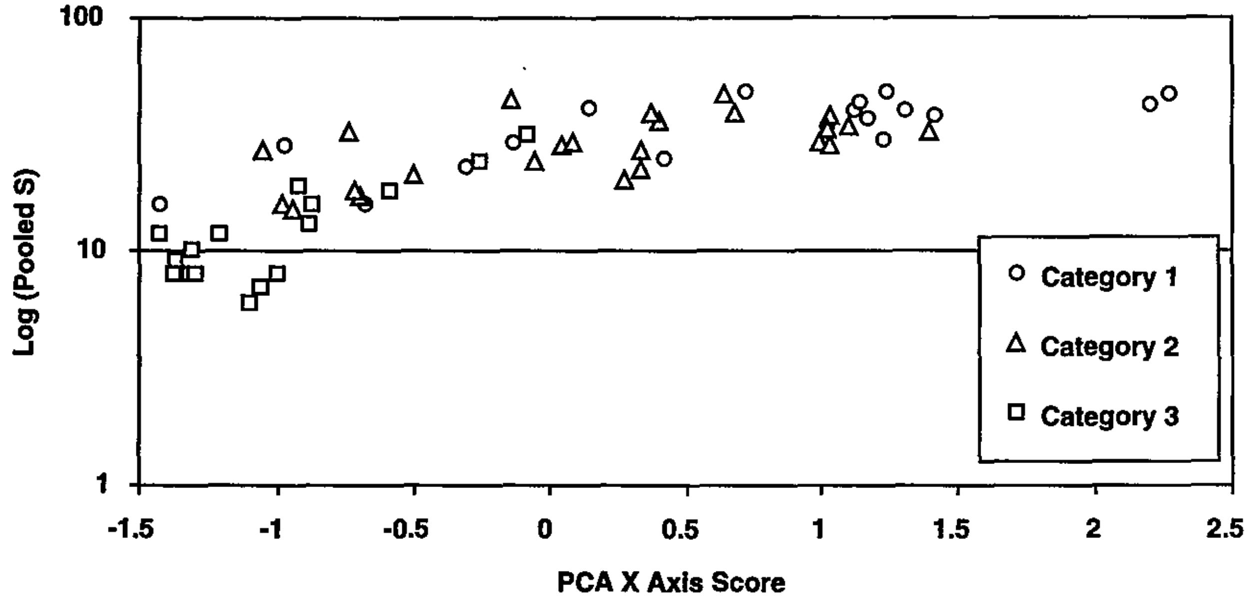



**Figure 3-4. Plot of pooled species richness vs. PCA 1st component scores.**

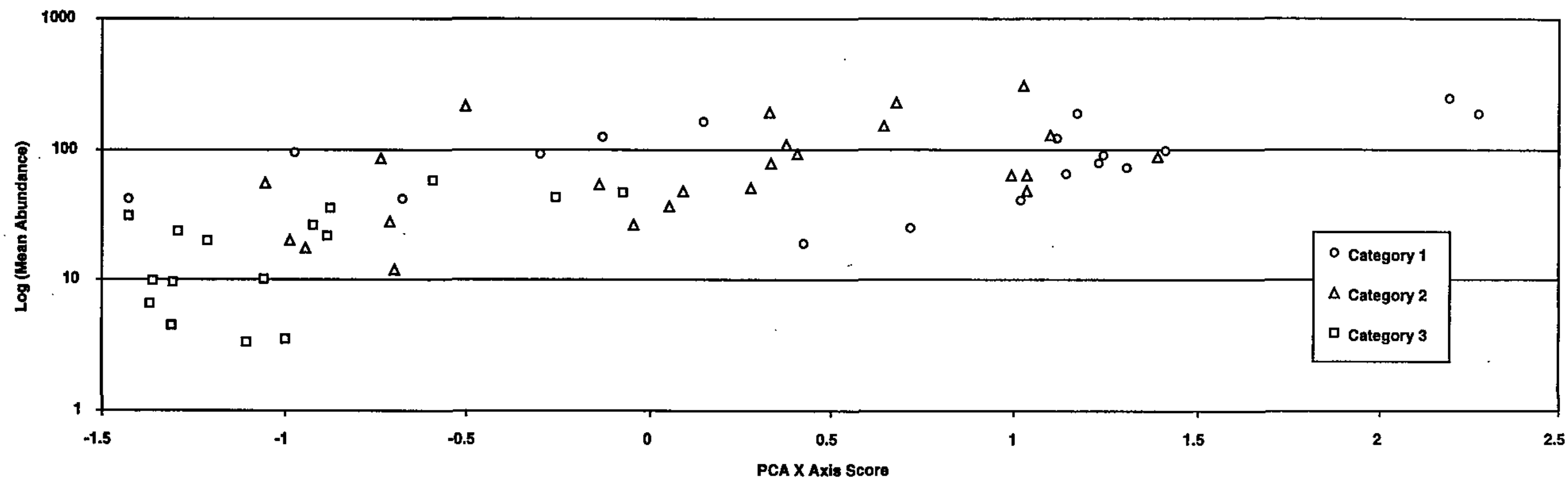
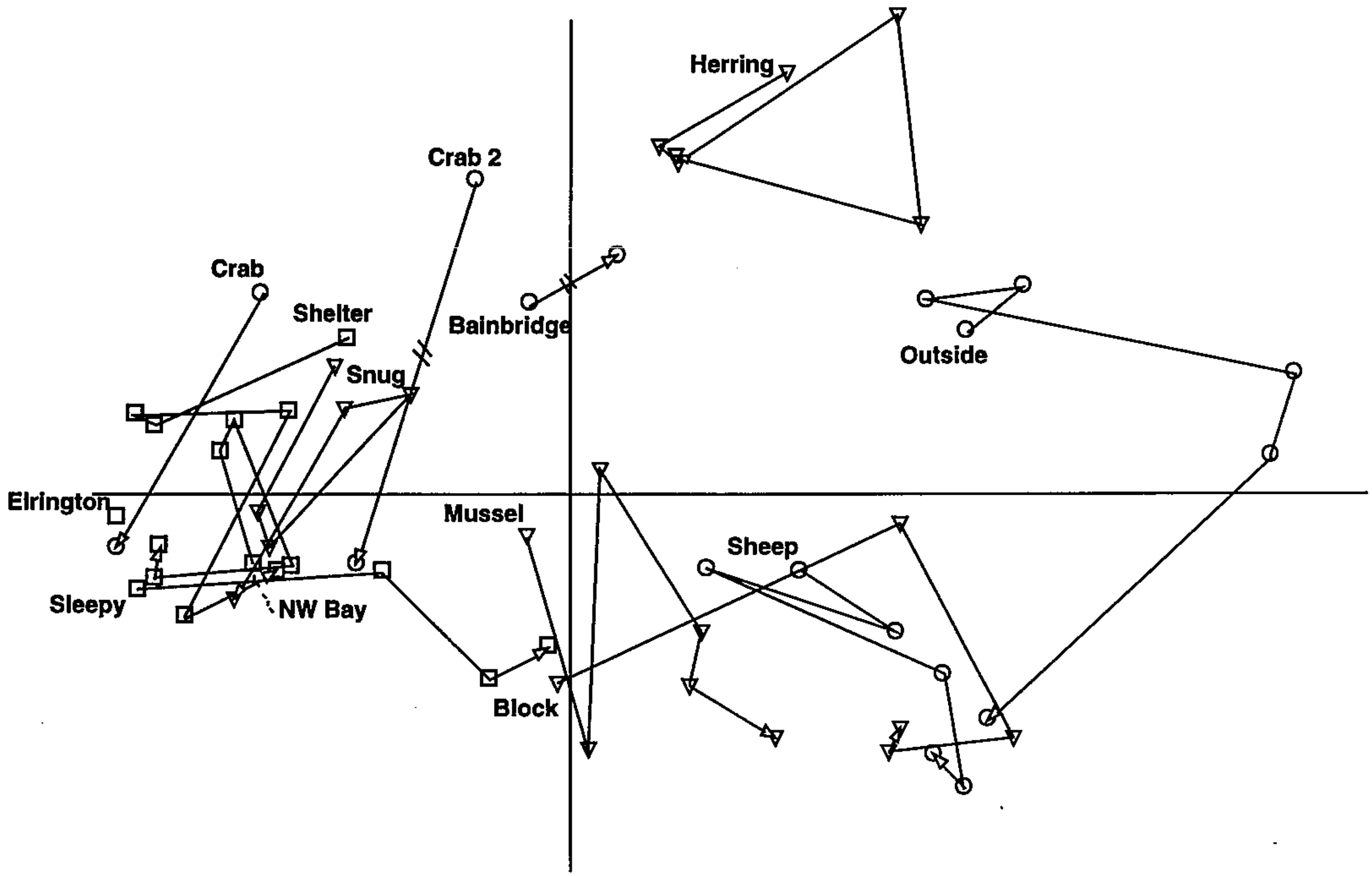



**Figure 3-5. Plot of mean abundance vs. PCA 1st component scores.**




Note: Connecting lines depict the movement of the sites through succeeding years of sampling beginning at the name label and terminating with the arrow pointing at the 1994 sampling. Broken lines indicate missing years in the sampling sequence.

**Figure 3-6. Principal component analysis of infaunal species abundance, 1989-94.**

**Table 3-4. Pearson's correlation (r) of selected variables with PCA compontnes.**

| Variable* | X Axis | Y Axis |
|---|---|---|
| H′ (mean) | 0.59 | 0.41 |
| N (mean) | 0.54 | 0.42 |
| S (mean) | 0.84 | -0.08 |
| H′ (pooled) | 0.38 | -0.54 |
| Year | 0.10 | -0.30 |
| Category | -0.63 | -0.11 |
| TKN | -0.06 | 0.08 |
| TOC | -0.10 | -0.09 |
| Ln (PAH) | -0.42 | -0.43 |
| Gravel | -0.39 | 0.00 |
| Sand | 0.16 | -0.06 |
| Fine (≤125 μ) | 0.46 | 0.07 |

* Some sediment quality data missing in 1990 and 1991. No sediment quality data from 1989.

Placement of the Category 2 Snug Harbor site in the midst of the cluster of Category 3 sites was unexpected; however, the relative impoverishment of the Snug site is certainly influenced more by this site's physical and hydrologic characteristics than by any lingering effect of oiling. The site labeled Crab is the original 1989-90 Category 1 Crab site that was located on a sand bar close to a stream mouth; the site labeled Crab 2 has been sampled since 1992.

There is an artifact of the analysis that has rotated Mussel and Herring into opposite quadrants than those seen in the PCA from previous years. This rotation may be a result of dropping the extraneous sites included previously. A closer inspection of the Y component eigenvector may reveal the driving species variables.

# CHAPTER 4
# MOLLUSK STUDIES

## INTRODUCTION

The effects of the spill and subsequent shoreline treatments on hardshell clams at lower mixed-soft stations have been investigated over the 1989 to 1994 period using three primary techniques:

1. Randomly placed 0.25-$m^2$ quadrats were excavated in each year, except 1993, to evaluate densities of larger clams (e.g., > 5 mm) at lower elevation stations.

2. Small clams were separated from the infaunal cores at each station to evaluate recruitment.

3. Experimental transplants of clams in 1991 and 1992-93 were used to help understand the survival, growth, and uptake of hydrocarbons by the littleneck clam *Protothaca staminea*.

Another transplant experiment to expand on this understanding and examine factors influencing littleneck recruitment was initiated in June 1994 and will be recovered in 1995. Analyses were also conducted of the histopathology and reproductive maturity of clams and mussels with different exposure histories.

## METHODS

### *Distribution, Abundance, Age, and Growth*

At selected lower mixed-soft stations sampled in each year, littleneck and butter (*Saxidomus giganteus*) clams were collected in 0.009-$m^2$ core samples sieved for macroinfauna (Chapter 3). These clams were included in analyses of infauna assemblage characteristics described in Chapter 3 and were also examined as individual species in this chapter. The densities of juvenile clams (age 0 and 1) are defined as a Recruitment Index (RI) and are considered a measure of recruitment success.

In each year except 1993, four randomly located 0.25-$m^2$ quadrats have been excavated and hand-sorted to remove larger bivalves. This method provides a more efficient quantitative sampling of larger hardshell clams than methods employing screens (Houghton 1973). Butter and littleneck clams larger than 5 mm were retained and frozen for length and age analyses in the laboratory.

For the purpose of making comparisons over time, some stations that were anomalous (having atypical substrate characteristics or uncertain treatment histories) or were inconsistently sampled have been excluded from the data set. Stations included in each year's analyses of 0.009-$m^2$ cores and in 0.25-$m^2$ quadrat excavations are presented by treatment category in Tables 4-1 through 4-5 and 4-6 through 4-9, respectively. These tables are revised somewhat from those presented in earlier reports and statistical analyses have been reapplied.

Because erosion in the umbonal region makes identification of the first annulus difficult on older venerid clams, littleneck and butter clams were aged using a modification of the methods and conventions of Houghton (1973). Specifically, rings less than 2.5 mm long were not counted as annuli, and no first annulus was recorded as greater than 8 mm. When the first distinct ring was greater than 8 mm, this ring was assumed to be the second annulus, and the first annulus was recorded as 2.5 mm. In addition, the external sculpture was filed to help distinguish true annuli from disturbance checks. Total length and lengths of the last three annuli were measured to the nearest tenth of a millimeter.

### *Field Transplant Experiments*

#### 1991

An experiment to examine survival, growth, and hydrocarbon uptake of clams transplanted to previously oiled sites was completed during 1991. Approximately 1,000 littleneck clams were collected in May 1991 from the lower reference station at Bainbridge Bight. Clams were immediately placed in a calcein solution for a minimum of 18 hours. At each transplant site, wooden (0.25-$m^2$) quadrats were dug into the sediment flush with the surface along the lower elevation beach contour. Sediments within the quadrat were hand dug to a depth of 10 to 15 cm to loosen the material for planting and to remove indigenous clams for tissue hydrocarbon analysis. A sediment sample was also taken from each of the quadrats for hydrocarbon analysis. One hundred clams of varying sizes were buried in ten equally spaced rows of ten clams to each quadrat.

Table 4-1. Abundance of age 0 and 1 *Protothaca staminea* from 0.009-$m^2$ cores, summer 1990.

| Category and Location | Total number of clams in five cores | | | Percent of age 0 and age 1 of total | Density (no.0.25$m^2$) | |
|---|---|---|---|---|---|---|
| | Age 0 | Age 1 | All Ages | | Age 0 & 1 | All ages |
| Category 1—Unoiled | | | | | | |
| Outside Bay | 4 | 1 | 6 | 83.3 | 27.8 | 33.3 |
| Sheep Bay | 7 | 2 | 14 | 64.3 | 50.0 | 77.8 |
| **Category 1 mean** | **5.5** | **1.5** | **10.0** | **70.0** | **38.9** | **55.6** |
| Category 2—Oiled, untreated | | | | | | |
| Block Island | 3 | 0 | 11 | 27.3 | 20.8 | 76.4 |
| Herring Bay | 0 | 0 | 1 | 0.0 | 0.0 | 5.6 |
| Mussel Beach South | 2 | 2 | 7 | 57.1 | 22.2 | 38.9 |
| Snug Harbor | 0 | 0 | 1 | 0.0 | 0.0 | 5.6 |
| **Category 2 mean** | **1.3** | **0.5** | **5.0** | **35.0** | **10.8** | **31.6** |
| Category 3—Oiled, treated | | | | | | |
| NW Bay West Arm | 2 | 0 | 2 | 100.0 | 11.1 | 11.1 |
| Shelter Bay | 0 | 1 | 1 | 100.0 | 5.6 | 5.6 |
| **Category 3 mean** | **1.0** | **0.5** | **1.5** | **100.0** | **8.3** | **8.3** |
| **Statistical tests** | | | | | | |
| t-tests | | | | | | |
| 1 vs. 2 (2-tail) | | | | | 0.13 | |
| 1 vs. 3 (1-tail) | | | | | 0.16 | |
| 2 vs. 3 (1-tail) | | | | | 0.39 | |

Table 4-2. Abundance of age 0 and 1 *Protothaca staminea* from 0.009-m$^2$ cores, summer 1991.

| | Total number of clams in five cores | | | Percent of age 0 and age 1 of total | Density (no.0.25m$^2$) | |
|---|---|---|---|---|---|---|
| **Category and Location** | **Age 0** | **Age 1** | **All Ages** | | **Age 0 & 1** | **All ages** |
| Category 1—Unoiled | | | | | | |
| Outside Bay | 4 | 2 | 12 | 50.0 | 33.33 | 77.8 |
| Sheep Bay | 4 | 1 | 11.5 | 45.5 | 27.8 | 66.7 |
| **Category 1 mean** | **4.0** | **1.5** | **11.5** | **47.8** | **30.6** | **72.2** |
| Category 2—Oiled, untreated | | | | | | |
| Block Island | 24 | 1 | 32 | 78.1 | 138.9 | 183.3 |
| Herring Bay | 0 | 0 | 1 | 0.0 | 0.0 | 5.6 |
| Mussel Beach South | 14 | 0 | 15 | 93.3 | 77.8 | 83.3 |
| Snug Harbor | 0 | 0 | 3 | 0.0 | 0.0 | 16.7 |
| **Category 2 mean** | **9.5** | **0.3** | **12.8** | **76.5** | **54.2** | **72.2** |
| Category 3—Oiled, treated | | | | | | |
| NW Bay West Arm | 1 | 1 | 2 | 100.0 | 11.1 | 16.7 |
| Shelter Bay | 0 | 0 | 0 | 0.0 | 0.0 | 0.0 |
| Sleepy Bay | 1 | 0 | 1 | 100.0 | 5.6 | 5.6 |
| **Category 3 mean** | **0.7** | **0.3** | **1.0** | **100.0** | **5.6** | **7.4** |
| **Statistical tests** | | | | | | |
| t-tests | | | | | | |
| 1 vs. 2 (2-tail) | | | | | 0.73 | |
| 1 vs. 3 (1-tail) | | | | | 0.10 | |
| 2 vs. 3 (1-tail) | | | | | 0.29 | |

Table 4-3. Abundance of age 0 and 1 *Protothaca staminea* from 0.009-$m^2$ cores, summer 1992

| Category and Location | Total number of clams in five cores | | | Percent of age 0 and age 1 of total | Density (no.0.25$m^2$) | |
|---|---|---|---|---|---|---|
| | Age 0 | Age 1 | All Ages | | Age 0 & 1 | All ages |
| Category 1—Unoiled | | | | | | |
| Crab Bay | 0 | 0 | 3 | 0.0 | 0.0 | 16.7 |
| Outside Bay | 25 | 2 | 29 | 93.1 | 150.0 | 161.1 |
| Sheep Bay | 46 | 4 | 57 | 87.7 | 277.8 | 316.7 |
| **Category 1 mean** | **23.7** | **2.0** | **29.7** | **86.5** | **142.6** | **164.8** |
| Category 2—Oiled, untreated | | | | | | |
| Block Island | 43 | 11 | 62 | 87.1 | 300.0 | 344.4 |
| Herring Bay | 0 | 0 | 0 | 0.0 | 0.0 | 0.0 |
| Mussel Beach South | 38 | 3 | 46 | 89.1 | 227.8 | 255.6 |
| Snug Harbor | 0 | 0 | 0 | 0.0 | 0.0 | 0..0 |
| **Category 2 mean** | **20.3** | **3.5** | **27.0** | **88.0** | **131.9** | **150.0** |
| Category 3—Oiled, treated | | | | | | |
| NW Bay West Arm | 0 | 0 | 0 | 0.0 | 0.0 | 0.0 |
| Shelter Bay | 0 | 0 | 1 | 0.0 | 0.0 | 0.0 |
| Sleepy Bay | 2 | 0 | 2 | 100.0 | 11.1 | 11.1 |
| **Category 3 mean** | **0.7** | **0.0** | **1.0** | **66.7** | **3.7** | **5.6** |
| **Statistical tests** | | | | | | |
| t-tests | | | | | | |
| 1 vs. 2 (2-tail) | | | | | 1.00 | |
| 1 vs. 3 (1-tail) | | | | | 0.21 | |
| 2 vs. 3 (1-tail) | | | | | 0.29 | |

Table 4-4. Abundance of age 0 and 1 *Protothaca staminea* from 0.009-$m^2$ cores, summer 1993.

| Category and Location | Total number of clams in five cores | | | Percent of age 0 and age 1 of total | Density (no.0.25m²) | |
|---|---|---|---|---|---|---|
| | Age 0 | Age 1 | All Ages | | Age 0 & 1 | All ages |
| Category 1—Unoiled | | | | | | |
| Crab Bay | 0 | 0 | 0 | 0.0 | 0.0 | 0.0 |
| Outside Bay | 18 | 5 | 29 | 79.3 | 127.8 | 161.1 |
| Sheep Bay | 1 | 29 | 55 | 54.5 | 166.7 | 305.6 |
| **Category 1 mean** | **6.3** | **11.3** | **28.0** | **63.1** | **98.1** | **155.6** |
| Category 2—Oiled, untreated | | | | | | |
| Block Island | 5 | 18 | 43 | 53.5 | 127.8 | 238.9 |
| Herring Bay | 1 | 0 | 2 | 50.0 | 5.6 | 11.1 |
| Mussel Beach South | 6 | 0 | 15 | 40.0 | 33.3 | 83.3 |
| Snug Harbor | 0 | 1 | 1 | 100.0 | 5.6 | 5.6 |
| **Category 2 mean** | **3.0** | **4.8** | **15.3** | **50.8** | **43.1** | **84.7** |
| Category 3—Oiled, treated | | | | | | |
| NW Bay West Arm | 2 | 0 | 2 | 100.0 | 11.1 | 11.1 |
| Shelter Bay | 1 | 1 | 2 | 100.0 | 11.1 | 11.1 |
| Sleepy Bay | 3 | 0 | 3 | 100.0 | 16.7 | 16.7 |
| **Category 3 mean** | **2.0** | **0.3** | **2.3** | **100.0** | **13.0** | **13.0** |
| **Statistical tests** | | | | | | |
| t-tests | | | | | | |
| 1 vs. 2 (2-tail) | | | | | 0.57 | |
| 1 vs. 3 (1-tail) | | | | | 0.05 | |
| 2 vs. 3 (1-tail) | | | | | 0.11 | |

**Table 4-5. Abundance of age 0 and 1 *Protothaca staminea* from 0.009-m$^2$ cores, summer 1994**

| Category and Location | Total number of clams in five cores | | | Percent of age 0 and age 1 of total | Density (no.0.25m$^2$) | |
|---|---|---|---|---|---|---|
| | Age 0 | Age 1 | All Ages | | Age 0 & 1 | All ages |
| Category 1—Unoiled | | | | | | |
| Crab Bay | 0 | 1 | 5 | 20.0 | 5.0 | 27.8 |
| Outside Bay | 3 | 5 | 20 | 40.0 | 44.4 | 111.1 |
| Sheep Bay | 3 | 3 | 20 | 30.0 | 33.3 | 111.1 |
| **Category 1 mean** | **2.0** | **3.0** | **15.0** | **33/3** | **28/9** | **93/3** |
| Category 2—Oiled, untreated | | | | | | |
| Block Island | 7 | 2 | 38 | 21.6 | 44.4 | 205.6 |
| Herring Bay | 0 | 0 | 3 | 0.0 | 0.0 | 16.7 |
| Mussel Beach South | 17 | 7 | 32 | 75.0 | 133.3 | 177.8 |
| Snug Harbor | 0 | 0 | 2 | 0.0 | 0.0 | 11.1 |
| **Category 2 mean** | **5.8** | **2.3** | **18.5** | **43.2** | **44.4** | **102.8** |
| Category 3—Oiled, treated | | | | | | |
| NW Bay West Arm | 0 | 0 | 0 | 0.0 | 0.0 | 0.0 |
| Shelter Bay | 3 | 0 | 3 | 100.0 | 16.7 | 16.7 |
| Sleepy Bay | 1 | 0 | 1 | 100.0 | 5.6 | 5.6 |
| **Category 3 mean** | **1.3** | **0.0** | **1.3** | **100.0** | **7.4** | **7.4** |
| **Statistical tests** | | | | | | |
| t-tests | | | | | | |
| 1 vs. 2 (2-tail) | | | | | 0.60 | |
| 1 vs. 3 (1-tail) | | | | | 0.15 | |
| 2 vs. 3 (1-tail) | | | | | 0.28 | |

Table 4-6 Abundance (no./0.25 m2) of hardshell clams at selected stations, summer 1990.

| Species and location | Category | Total | Mean (no./0.25-m2) | SD | Min | Max | Category mean (no./0.25-m2) | Category SD | ANOVA | t-tests 1 vs. 2 (2-tail) | t-tests 1 vs. 3 (1-tail) | t-tests 2 vs. 3 (1-tail) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Protothaca staminea*** | | | | | | | | | 0.55 | 0.93 | 0.16 | 0.21 |
| Outside Bay | 1 | 39 | 9.8 | 19.50 | 0 | 39 | | | | | | |
| Sheep Bay | 1 | 99 | 24.8 | 7.68 | 15 | 33 | | | | | | |
| | | | | | | | 17.3 | 10.61 | | | | |
| Block Island | 2 | 105 | 59.0 | 41.57 | 11 | 83 | | | | | | |
| Herring Bay | 2 | 34 | 8.5 | 6.24 | 1 | 15 | | | | | | |
| Mussel Beach South | 2 | 0 | 0.0 | 0.00 | 0 | 0 | | | | | | |
| Snug Harbor | 2 | 84 | 21.0 | 16.75 | 7 | 42 | | | | | | |
| | | | | | | | 22.1 | 26.05 | | | | |
| Shelter Bay | 3 | 2 | 0.5 | 1 | 0 | 2 | | | | | | |
| Northwest Bay West Arm | 3 | 3 | 0.8 | 0.50 | 0 | 1 | | | | | | |
| | | | | | | | 0.6 | 0.18 | | | | |
| ***Saxidomus giganteus*** | | | | | | | | | 0.21 | 0.26 | 0.16 | 0.40 |
| Outside Bay | 1 | 4 | 1.0 | 2.00 | 0 | 4 | | | | | | |
| Sheep Bay | 1 | 25 | 6.3 | 3.86 | 2 | 10 | | | | | | |
| | | | | | | | 3.6 | 3.71 | | | | |
| Block Island | 2 | 14 | 3.5 | 2.65 | 0 | 6 | | | | | | |
| Herring Bay | 2 | 6 | 1.5 | 1.29 | 0 | 3 | | | | | | |
| Mussel Beach South | 2 | 0 | 0.0 | 0.00 | 0 | 0 | | | | | | |
| Snug Harbor | 2 | 0 | 0.0 | 0.00 | 0 | 0 | | | | | | |
| | | | | | | | 1.3 | 1.66 | | | | |
| Shelter Bay | 3 | 0 | 0.0 | 0.00 | 0 | 0 | | | | | | |
| Northwest Bay West Arm | 3 | 0 | 0.0 | 0.00 | 0 | 0 | | | | | | |
| | | | | | | | 0.0 | 0.00 | | | | |

Table 4-7 Abundance (no./0.25 m2) of hardshell clams at selected stations, summer 1991.

| Species and location | Category | Total | Mean (no./0.25-m2) | SD | Min | Max | Category mean (no./0.25-m2) | Category SD | ANOVA | t-tests 1 vs. 2 (2-tail) | t-tests 1 vs. 3 (1-tail) | t-tests 2 vs. 3 (1-tail) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Protothaca staminea* | | | | | | | | | 0.02 | 0.20 | 0.11 | 0.03 |
| Outside Bay | 1 | 94 | 23.5 | 13.80 | 6 | 38 | | | | | | |
| Sheep Bay | 1 | 175 | 43.8 | 24.53 | 20 | 78 | | | | | | |
| | | | | | | | 33.6 | 14.32 | | | | |
| Block Island | 2 | 84 | 28.0 | 13.08 | 19 | 43 | | | | | | |
| Herring Bay | 2 | 39 | 9.8 | 13.52 | 2 | 30 | | | | | | |
| Mussel Beach South | 2 | 85 | 21.3 | 12.28 | 11 | 39 | | | | | | |
| Snug Harbor | 2 | 46 | 11.5 | 9.26 | 5 | 25 | | | | | | |
| | | | | | | | 17.6 | 8.57 | | | | |
| Shelter Bay | 3 | 10 | 2.5 | 3.00 | 0 | 6 | | | | | | |
| Sleepy Bay | 3 | 0 | 0.0 | 0.00 | 0 | 0 | | | | | | |
| Northwest Bay West Arm | 3 | 0 | 0.0 | 0.00 | 0 | 0 | | | | | | |
| *Saxidomus giganteus* | | | | | | | | | 0.26 | 1.00 | 0.10 | 0.06 |
| Outside Bay | 1 | 8 | 2 | 1.15 | 1 | 3 | | | | | | |
| Sheep Bay | 1 | 24 | 6.0 | 2.16 | 3 | 8 | | | | | | |
| | | | | | | | 4.0 | 2.83 | | | | |
| Block Island | 2 | 13 | 4.3 | 3.06 | 1 | 7 | | | | | | |
| Herring Bay | 2 | 6 | 1.5 | 2.38 | 0 | 5 | | | | | | |
| Mussel Beach South | 2 | 38 | 9.5 | 7.85 | 4 | 21 | | | | | | |
| Snug Harbor | 2 | 2 | 0.5 | 1.00 | 0 | 2 | | | | | | |
| | | | | | | | 4.0 | 4.04 | | | | |
| Shelter Bay | 3 | 0 | 0.0 | 0.00 | 0 | 0 | | | | | | |
| Sleepy Bay | 3 | 3 | 0.75 | 0.96 | 0 | 2 | | | | | | |
| Northwest Bay West Arm | 3 | 0 | 0.0 | 0.00 | 0 | 0 | | | | | | |
| | | | | | | | 0.3 | 0.43 | | | | |

**Table 4-8 Abundance (no./0.25 m2) of hardshell clams at selected stations, summer 1992.**

| Species and location | Category | Total | Mean (no./0.25-m2) | S. SDD | Min | Max | Category mean (no./0.25-m2) | Category S. D. | ANOVA | t-tests 1 vs. 2 (2-tail) | 1 vs. 3 (1-tail) | 2 vs. 3 (1-tail) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Protothaca staminea*** | | | | | | | | | 0.34 | 0.80 | 0.05 | 0.03 |
| Crab Bay | 1 | 62 | 15.5 | 6.56 | 10 | 23 | | | | | | |
| Outside Bay | 1 | 56 | 14.0 | 4.08 | 8 | 17 | | | | | | |
| Sheep Bay | 1 | 210 | 52.5 | 5.80 | 47 | 58 | | SD | | | | |
| | | | | | | | 27.3 | 21.81 | | | | |
| Block Island | 2 | 408 | 102.0 | 75.39 | 50 | 214 | | | | | | |
| Herring Bay | 2 | 15 | 3.8 | 3.30 | 0 | 8 | | | | | | |
| Mussel Beach South | 2 | 176 | 44.0 | 20.64 | 22 | 64 | | | | | | |
| Snug Harbor | 2 | 43 | 10.8 | 10.44 | 1 | 24 | | | | | | |
| | | | | | | | 40.1 | 44.83 | | | | |
| Shelter Bay | 3 | 11 | 2.8 | 5.50 | 0 | 11 | | | | | | |
| Sleepy Bay | 3 | 2 | 0.5 | 1.00 | 0 | 2 | | | | | | |
| Northwest Bay West Arm | 3 | 10 | 2.5 | 2.08 | 0 | 5 | | | | | | |
| | | | | | | | 1.9 | 1.23 | | | | |
| ***Saxidomus giganteus*** | | | | | | | | | 0.50 | 0.74 | 0.20 | 0.26 |
| Crab Bay | 1 | 0 | 0.0 | 0.00 | 0 | 0 | | | | | | |
| Outside Bay | 1 | 11 | 2.8 | 0.96 | 2 | 4 | | | | | | |
| Sheep Bay | 1 | 32 | 8.0 | 3.65 | 4 | 12 | | | | | | |
| | | | | | | | 3.6 | 4.06 | | | | |
| Block Island | 2 | 29 | 7.3 | 10.18 | 0 | 22 | | | | | | |
| Herring Bay | 2 | 0 | 0.0 | 0.00 | 0 | 0 | | | | | | |
| Mussel Beach South | 2 | 53 | 13.3 | 5.74 | 5 | 18 | | | | | | |
| Snug Harbor | 2 | 1 | 0.3 | 0.50 | 0 | 1 | | | | | | |
| | | | | | | | 5.2 | 6.34 | | | | |
| Shelter Bay | 3 | 1 | 1.0 | 0.00 | 1 | 1 | | | | | | |
| Sleepy Bay | 3 | 2 | 0.5 | 1.00 | 0 | 2 | | | | | | |
| Northwest Bay West Arm | 3 | 0 | 0.0 | 0.00 | 0 | 0 | | | | | | |
| | | | | | | | 0.5 | 0.50 | | | | |

Table 4-9 Abundance (no./0.25 m2) of hardshell clams at selected stations, summer 1994.

| Species and location | Category | Total | Mean (no./0.25-m2) | SD | Min | Max | Category mean (no./0.25-m2) | Category SD | ANOVA | t-tests 1 vs. 2 (2-tail) | t-tests 1 vs. 3 (1-tail) | t-tests 2 vs. 3 (1-tail) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Protothaca staminea*** | | | | | | | | | 0.37 | 0.91 | 0.09 | 0.05 |
| Crab Bay | 1 | 69 | 17.3 | 4.11 | 12 | 22 | | | | | | |
| Outside Bay | 1 | 33 | 8.3 | 5.32 | 4 | 15 | | | | | | |
| Sheep Bay | 1 | 333 | 83.3 | 49.39 | 42 | 155 | | | | | | |
| | | | | | | | 36.3 | 40.95 | | | | |
| Block Island | 2 | 336 | 84.0 | 54.77 | 26 | 158 | | | | | | |
| Herring Bay | 2 | 27 | 6.8 | 7.14 | 1 | 17 | | | | | | |
| Mussel Beach South | 2 | 254 | 63.5 | 45.42 | 18 | 111 | | | | | | |
| Snug Harbor | 2 | 57 | 14.3 | 4.50 | 8 | 18 | | | | | | |
| | | | | | | | 42.1 | 37.59 | | | | |
| Shelter Bay | 3 | 0 | 0.0 | 0.00 | 0 | 0 | | | | | | |
| Sleepy Bay | 3 | 0 | 0.0 | 0.00 | 0 | 0 | | | | | | |
| Northwest Bay West Arm | 3 | 40 | 10.0 | 3.46 | 7 | 13 | | | | | | |
| | | | | | | | 3.3 | 5.77 | | | | |
| ***Saxidomus giganteus*** | | | | | | | | | 0.53 | 0.71 | 0.50 | 0.27 |
| Crab Bay | 1 | 0 | 0.0 | 0.00 | 0 | 0 | | | | | | |
| Outside Bay | 1 | 0 | 0.0 | 0.00 | 0 | 0 | | | | | | |
| Sheep Bay | 1 | 17 | 4.3 | 2.06 | 2 | 7 | | | | | | |
| | | | | | | | 1.4 | 2.45 | | | | |
| Block Island | 2 | 13 | 3.3 | 2.22 | 1 | 6 | | | | | | |
| Herring Bay | 2 | 0 | 0.0 | 0.00 | 0 | 0 | | | | | | |
| Mussel Beach South | 2 | 28 | 7.0 | 3.74 | 3 | 12 | | | | | | |
| Snug Harbor | 2 | 0 | 0.0 | 0.00 | 0 | 0 | | | | | | |
| | | | | | | | 2.6 | 3.33 | | | | |
| Shelter Bay | 3 | 0 | 0.0 | 0.00 | 0 | 0 | | | | | | |
| Sleepy Bay | 3 | 0 | 0.0 | 0.00 | 0 | 0 | | | | | | |
| Northwest Bay West Arm | 3 | 0 | 0.0 | 0.00 | 0 | 0 | | | | | | |
| | | | | | | | 0.0 | 0.00 | | | | |

Three sites were used for the experiment.

- Five replicate quadrats were placed at the heavily oiled but untreated Block Island lower station across an apparent gradient of residual sediment hydrocarbon concentration.
- Four replicate quadrats were similarly arranged at the oiled and hot-water washed Northwest Bay West Arm site in an area where no hydrocarbons were evident.
- A single sample was replaced at the unoiled Bainbridge Bight lower station.

During the September 1991 survey, all live and dead clams were removed from within the wooden frames and frozen for later laboratory analyses.

1992-1993

A second experiment to examine survival, growth, and hydrocarbon uptake of clams transplanted to previously oiled sites was initiated during 1992. Approximately 800 littleneck clams were collected from near the lower reference station at Bainbridge Bight and placed in a calcein solution for a minimum of 18 hours. At the transplant site at Block Island, clams were transplanted into 1.5 randomly located quadrats on each of three parallel transects established along the beach contour; two transects were located above the existing lower mixed-soft station, and one was below the station. Quadrat installation and clam placement was as described in the 1991 experiment except that 90 clams were buried in 10 rows of 9 within the quadrats in the middle transect, and 25 clams were buried (5 rows of 5) in the upper and lower transects. An additional quadrat of 40 clams was placed at the lower station at Mussel Beach South to serve as a reference.

All littleneck transplant quadrats were left in place over the winter and excavated and hand-sorted to remove larger bivalves in late June and early July 1993. Counts of living butter and littleneck clams larger than 4 to 5 mm were made in the field. All clams recovered were retained and frozen for hydrocarbon, length, and age analyses, except that one-half of the clams from the middle transect (those planted with 90 clams) were preserved in Davidson's solution for histopathology and gonadal analysis. Attempts to open the clams before placing them in the Davidson's solution were not successful.

Surface sediment samples were taken and frozen from each of the 15 quadrat locations at the time of planting and again at the time of recovery and forwarded to LSU for hydrocarbon analysis.

1994-1995

A third transplant experiment was initiated in June 1994. Approximately 750 littleneck clams were collected from near the lower reference station at Outside Bay, and approximately 200 clams were collected from near the lower station at Block Island. Tagging in 1994 used a direct mark to permanently identify individual clams (e.g., Houghton 1973) so they can be measured at the beginning and at the end of the experiment, increasing the statistical power of the results. Each clam was marked by engraving a number in the side of its shell with a Dremel tool; the number was inked in with a permanent marker and the mark was covered with clear nail polish or marine epoxy. Animals were held in fresh seawater for a maximum of two days following marking before transplanting. During this holding period, water was changed several times a day.

At the transplant site at Block Island, wooden quadrats (0.25 $m^2$) were dug into the sediment flush with the sediment surface just below the existing lower intertidal transect. Marked Outside Bay clams were transplanted into six quadrats randomly located on a transect established along the beach contour. Quadrat installation and clam placement was as described in the 1991 experiment except that 80 clams were buried in each quadrat. Use of 80 clams per quadrat made it easier to load clams into the quadrats without interference, yet should continue to provide adequate numbers of clams for growth and survival studies.

Similar marking and transplanting techniques were used to transplant 80 Outside Bay clams into one plot and to transplant 80 Block Island clams into two plots at the Outside Bay lower station for cross comparisons.

All littleneck transplant quadrats will be left in place over the winter and excavated and hand sorted to remove tagged bivalves in July 1995. Counts of living littleneck clams larger than 4 to 5 mm will be made in the field. All clams recovered will either be measured in the field (total length and length at the 1994 abd 1995 annulus) and replanted; retained and frozen for laboratory hydrocarbon, length, and age analyses; or preserved in Davidson's solution for histopathology and gonadal analysis.

## *Settling Experiment*

An experiment was begun in 1994 to test hypotheses regarding factors that appear to be limiting recruitment of littleneck and butter clams, as well as infauna, to beaches that were hydraulically washed. Experimental units consisted of perforated plastic flower pots, filled with specified test sediments, and set into the beach in question. Reciprocal sediment exchanges between sites with good and poor recruitment and detailed chemical and physical analysis of sediments were used to enhance our understanding of causative factors. Each experimental treatment was replicated five times at each test site.

The following sediment treatments were established at:

1. Northwest Bay West Arm (local, local with added silt fraction, Outside Bay)

2. Block Island (local, Northwest Bay, Northwest Bay with added silt fraction)

3. Outside Bay (local, Northwest Bay, Northwest Bay with added silt fraction)

Sediment for the "added silt fraction" was obtained at about mean lower low water (MLLW) at the head of the lagoon on the north side of the isthmus separating Eleanor and Block islands. This sediment was a black mud with a high content of organic material. This sediment was mixed about half and half with the Northwest Bay West Arm sediment to make up the material used in the "NW Bay with added silt fraction" test sediment.

Test sediments were treated with hot freshwater to kill existing infauna and each pot was filled and set in the beach at the lower tidal elevation. Samples of each test sediment were retained for analysis of initial grain size (Appendix Table A-3), PAH (Block Island treatments only), TOC, and TKN. The top flange on each pot was set flush with the ambient sediment surface and attached to a rebar stake with a plastic tie wrap. Replicates of different treatments were randomly interspersed at each site to minimize bias.

In 1995, cores will be taken of the undisturbed sediments within the test pots (one per treatment) and field processed as are the standard C-15 samples for retention of infauna. Additional sediment will be composited from the remaining sediments in each treatment for end-of-experiment analysis of grain size, TOC, and TKN. PAH will only be analyzed from Block Island treatments and will not be composited so that any influence of the gradient of residual hydrocarbons can be evaluated.

### Histopathological Examination

One-half of the clams collected from the middle transect at Block Island 1992-93 experiment was shipped in Davidson's solution to Dr. Kenneth Brooks of Port Townsend, Washington, for sectioning and examination of gill and gonadal tissue.

### Statistical Analysis

Various statistical analyses were applied to quantitatively describe the abundance data and to evaluate the significance of the findings. In these tests, the mean of all subsamples (replicates) at a given station was used to represent each variable; thus, n = the number of stations within that category where the variable in question was measured. Randomization tests (see Chapter 3) were run to determine significant category effects (ANOVA) and differences between treatment categories (t-tests). Only two-tailed t-test results were considered in comparisons of Category 1 and 2 stations, based on the observation that in the last several years there has been no consistent pattern of differences in clam abundance between these two categories. One-tailed randomization t-tests were used where trends were being followed from the previous year and specific differences were predicted, e.g., that density of clams in Category 1 or 2 sites would exceed those in Category 3 sites. The randomization routines were adapted from algorithms published by Edgington (1987).

The residual toxicity of PAH to transplanted clams was examined by regressing the survival of clams against the total sediment concentration in the manner of Houghton et al. (1993a).

## RESULTS

### Recruitment

#### *Protothaca staminea*

Patterns of recruitment of littleneck clams at lower mixed-soft stations most consistently sampled during the study are shown in Figure 4-1 and in Table 4-1 through 4-6. A high degree of variability is seen in the recruitment at the several stations in each category. Since 1991, good recruitment has occurred at the Outside Bay and Sheep Bay Category 1 sites and at the Block Island and Mussel Beach Category 2 sites. In 1991 and 1992, Block Island had the highest RI (mean density, corrected to number/0.25 $m^2$, of age 0 and age 1 clams) of any site despite the continued presence of high concentrations of residual oil in the sediments. In contrast, two lightly oiled Category 2 sites (Herring Bay and Snug Harbor) and the unoiled Crab Bay site have had consistently poor recruitment; recruitment has been noted only in one year of the study at each of these sites.

RI at Category 1 sites has ranged from 27.8 in 1994 to 142.6 in 1992. At Category 2 sites, the RI was lowest in 1990 and has not differed significantly from the Category 1 sites in any year since. Recruitment at Category 3 sites has consistently been the poorest of any site category with a maximum of 13 in 1993. Despite the very high variability from station to station, the difference in recruitment between Category 1 and 3 stations was significant in 1991 and 1993 (Table 4-2 and 4-4).

Reflecting the low densities of older clams and the slow recovery of clam populations at oiled and treated sites, newly recruited clams comprised 100 percent of all clams taken in infaunal cores at all Category 3 sites since 1990 (Table 4-1 through 4-5). At Category 1 and 2 sites, newly recruited clams have averaged from 33.3 to 88 percent of clams taken in infaunal cores. Highest values in both Category 1 and 2 occurred in 1992 when recruitment was greatest.

*Saxidomus giganteus*

There has been little recruitment of butter clams and no increase in butter clam densities at Category 3 sites since 1989. Over the years, recruitment has been greatest at those stations with the highest butter clam densities including Outside Bay, Sheep Bay, Mussel Beach, and Block Island.

<u>Density</u>

*Protothaca staminea*

Trends in density of larger littleneck clams (≥ 5 mm) in 0.25-$m^2$ quadrat excavations at lower mixed-soft stations most consistently sampled during the study are shown in Figure 4-2 and in Table 4-6 through 4-9.

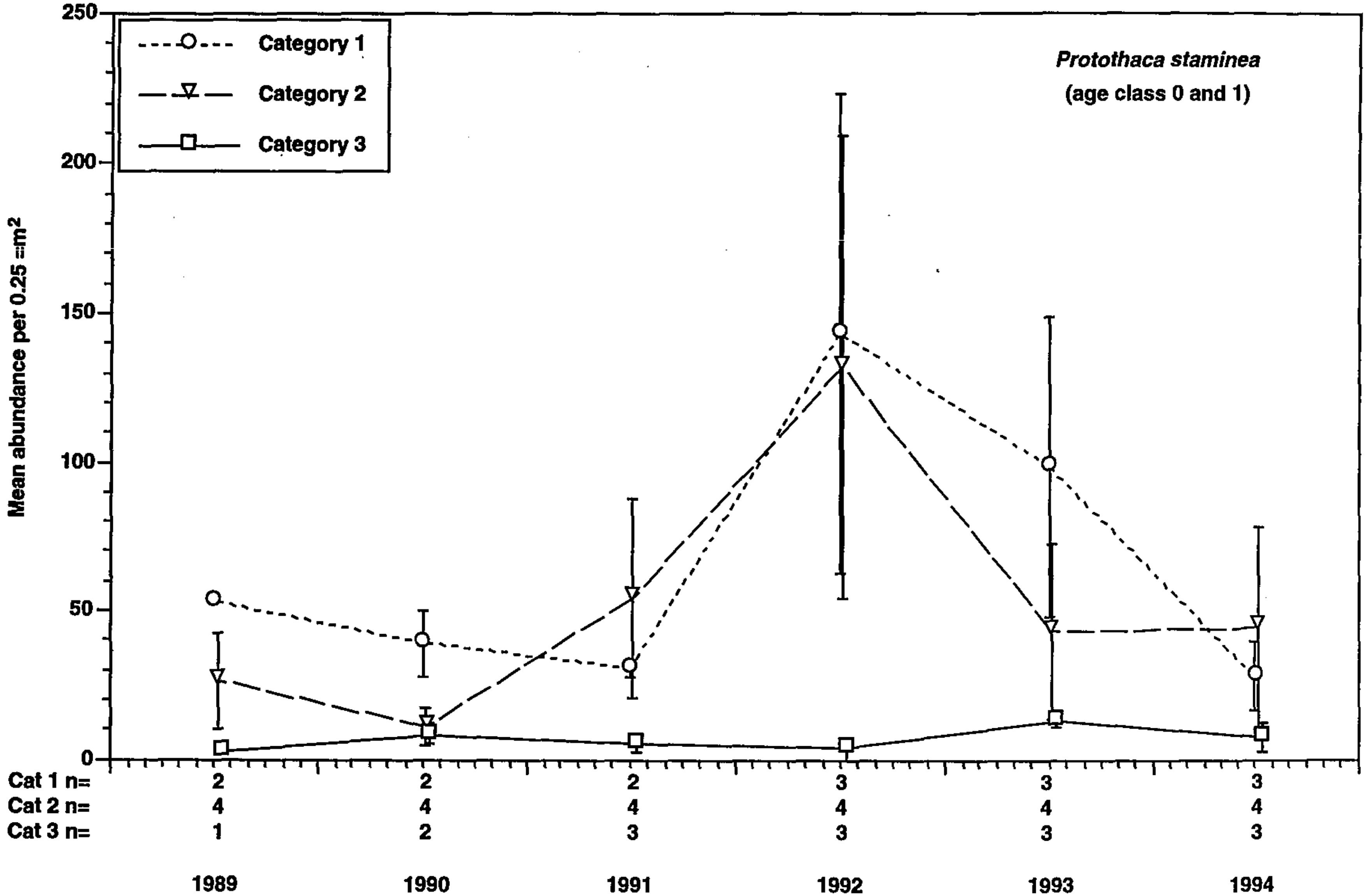



**Figure 4-1** Mean abundance (±1 SE) of littleneck clams, age class 0 and 1, from lower mixed-soft sites by category 1989-94. *1989 densities are for clams of all ages recovered in cores.

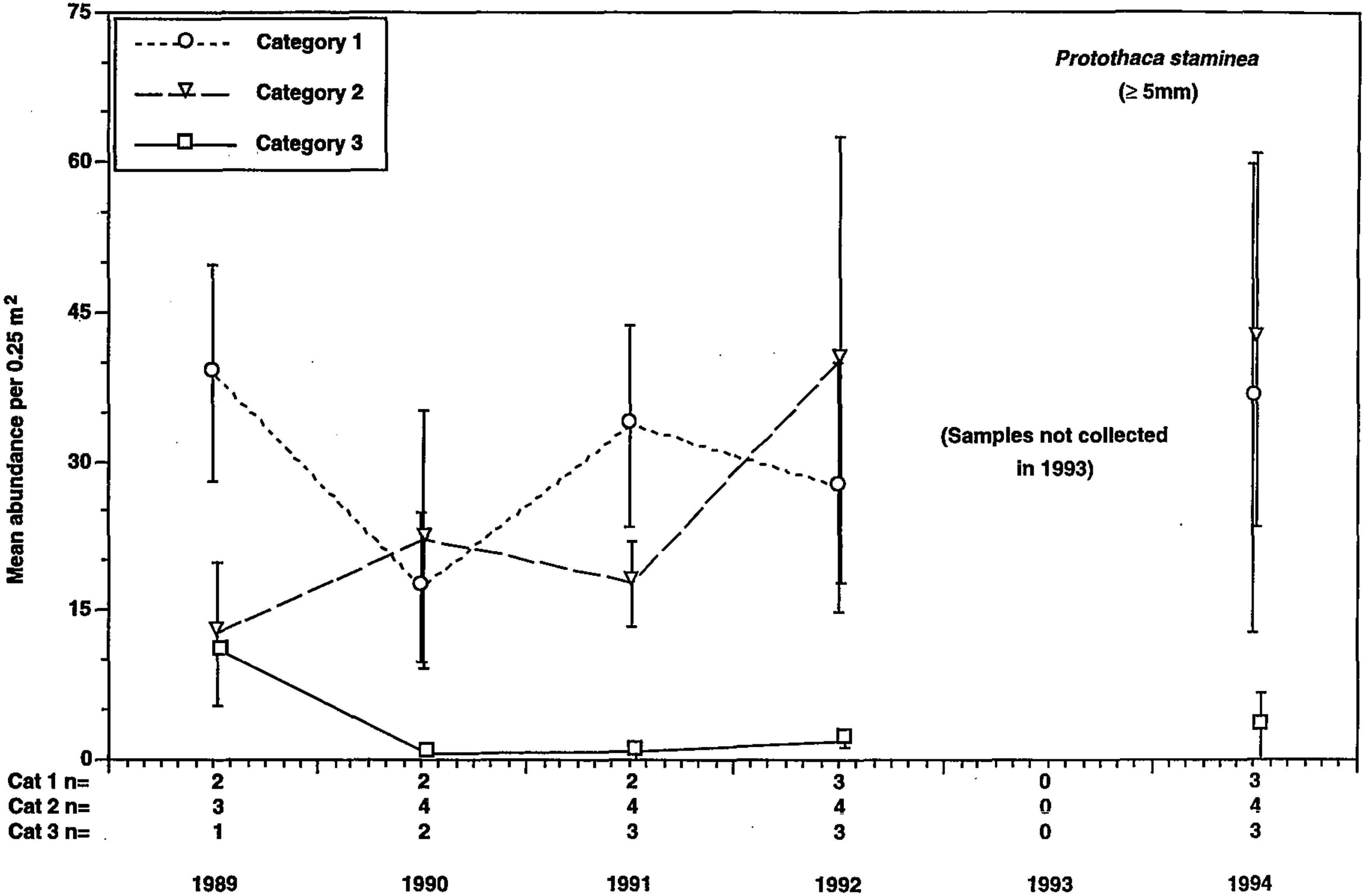



**Figure 4-2** Mean abundance (±1 SE) of littleneck clams (≥ 5mm), from lower mixed-soft sites by category 1989-94. * 1989 densities are for clams of all ages recovered in 0.25 $m^2$ excavations.

Effects of initial oiling on littleneck clams in 1989 have been described anecdotally by J. Michel (Research Planning, Inc. 1990. Personal communication) who reported very large numbers of freshly killed clams at the Block Island site in 1989. At our Northwest Bay Rocky Islet site on April 7, 1989, clams dug from sediments in oil-covered tide pools were tightly closed; no gaping clams were seen. Undoubtedly, there was some initial mortality of littleneck clams in areas (like Block Island) where fresh oil penetrated into sediments.

Our Northwest Bay West Arm mixed-soft station was first sampled on April 27, 1989. At this time, there were a few dead or moribund clams visible on the sediment surface immediately below the elevation sampled. Density of *Protothaca* at this lower station was 13.25/0.25 $m^2$. When this site was revisited in June of 1989, the entire area had been hydraulically washed. Excavations for clam population estimates showed much reduced densities of both species of hardshell clams (littleneck and butter) from April. Clams were found in two layers. A shallow group, buried only a few centimeters deep in the freshly deposited pebbles, apparently had been flushed downslope in the washing and had reburied themselves. A deeper group, about 20 to 25 centimeters below the surface, was apparently the indigenous population at that elevation which had been buried by the materials washed out from above. Many shells of dead clams were also found at this elevation. Clams that were excavated were taken to the research vessel and placed in clean seawater. Those from the upper group behaved normally, but of those from the deeper group, a large number did not survive. Density of apparently alive (shells intact and tightly closed) littleneck clams had declined from 13.25/0.25 $m^2$ in April to 7.59/0.25 $m^2$. The density of littleneck clams *P. staminea* at the lower station had declined further when sampled in July 1990 (to 0.80/0.25 $m^2$; Table 4-6) and clams were absent when sampled in 1991 (Table 4-7).

The other Category 3 site that was sampled before and after treatment did not show as dramatic a decline in littleneck clams because the only pretreatment sampling showed a relatively small population. Clam density at Shelter Bay declined from 3.67/0.25 $m^2$ before treatment to 0.5/0.25 $m^2$ in July 1990 after treatment. The third Category 3 site, Sleepy Bay, was not sampled in 1989.

Littleneck clam abundances at the Outside Bay and Sheep Bay reference sites have shown opposite temporal trends with an increasing abundance at Sheep Bay and a decline at Outside Bay. The latter apparent decline may be the result of the placement of all quadrats sampled in 1989 in the portion of the transect most suitable for clams, whereas subsequent sampling has been randomly spread across a 30-m transect line. There may also be effects from otter predation (1990 through 1992) and, in 1994, encroachment of a stream exiting a salt lagoon adjacent to the site.

The densities of littleneck clams measured at two of the Category 2 lower stations (Block Island and Mussel Beach) were relatively low during the 1989 through 1991 period suggesting the possibility of some oil related mortalities followed by recovery in subsequent years (1992 and 1994). Abundance of larger littlenecks at both of these stations increased dramatically between 1991 and 1992 as the large number of recruits in 1991 (Table 4-2) entered the population sampled. Relatively low and stable numbers of littlenecks at Herring Bay and Snug Harbor reflect the relatively low recruitment rates at those stations as well as the less suitable conditions for this species, rather than effects of oiling. Since 1990 when Block Island was first sampled, littleneck densities at Category 2 sites have not differed statistically from those at Category 1 sites (Figure 4-2 and Table 4-6 through 4-9).

Category 3 stations have had very few littlenecks throughout the study (Figure 4-2); densities have been significantly lower than at Category 1 and/or 2 stations in both years of the study when three Category 1 stations were available for testing (1992 and 1994). If data from Category 1 and 2 sites are pooled and tested against Category 3 sites, the differences are significant ($p \leq 0.1$) in all four years tested. Only at the Northwest Bay West Arm Category 3 station have clam densities increased significantly from their low (0.0/0.25 $m^2$ in 1991); density in 1994 (10.0/0.25 $m^2$) was similar to that (13.25/0.25 $m^2$) prior to hydraulic washing. The Shelter Bay Category 3 lower station had shown signs of recovering to near pretreatment densities (3.75/0.25 $m^2$) in 1991 and 1992 when densities of 2.5/0.25 $m^2$ were recorded; however, no clams were present in 1994 samples.

*Saxidomus giganteus*

Although not as abundant as littleneck clams at the elevations sampled, butter clams have followed a similar pattern of response to the oiling and shoreline treatment. Because their peak numbers likely occur at elevations lower than those sampled, however, and because the effects of oiling were typically greater at higher elevations, butter clams probably suffered less from the immediate effects of oiling. At the Northwest Bay West Arm lower station, butter clam density was 1.5/0.25 $m^2$ in April

1989 before treatment. Following treatment (June 1989) density declined to 0.25/0.25 $m^2$. Butter clams have not been taken at this site since June 1989 (Tables 4-6 through 4-9).

Butter clam numbers increased from 1990 to 1992 at Category 2 sites and exceeded those at unoiled Category 1 sites in 1992 and 1994. As at the West Arm site, there has been little recruitment and no increase in butter clam densities at other Category 3 sites.

# CHAPTER 5

# GENERAL DISCUSSION, SUMMARY, AND CONCLUSIONS

The general discussions, summary, and conclusions in this chapter are based on analyses conducted to date on samples collected from 1989 through 1994. It is anticipated that more detailed analyses of these data will be conducted and reported as funding permits.

## OVERALL IMPLICATIONS OF THE FINDINGS

Multiple null hypotheses relating to effects of hydrocarbon contamination from the tanker vessel *Exxon Valdez* and to effects of subsequent shoreline treatments have been tested in the six years of this study (1989 to 1994). Many of these null hypotheses have been rejected; these rejections indicate that significant differences existed in the condition of shorelines among our three categories of sites. For the majority of the variables tested, especially later in the study, conditions did not differ significantly among Category 1 (unoiled) and Category 2 (oiled but not high-pressure hot-water treated) sites. At Category 3 sites (those that were high-pressure hot-water washed), some variables differed significantly from levels at other site categories, especially early in the study, and were not fully recovered in 1994. In other cases, patterns apparent in the field or in the data were not statistically significant, but the data have been included and discussed to provide information on the direction of qualitative relationships among the categories. Time-series plots including data from 1989 through 1994 help evaluate these relationships. Plots presented in earlier reports have been updated with new data and have been modified somewhat to exclude data from stations not consistently sampled over the study period.

Expectations for the qualitative relationships among the treatment categories vary with the nature of the variable. Opportunistic species of epibiota, for instance, would be expected to be more abundant at Category 3 or Category 2 sites in the early years following the spill. This greater abundance was even more evident in 1991 and 1992 than in 1990; high abundances of opportunistic barnacles, littorines (*L. scutulata*), and algae (*Gloiopeltis* and several encrusting forms) were observed at Category 3 middle rocky stations. For most of these taxa, the "bloom" of opportunistic epibiotal species seen in 1990 through 1992 had disappeared or was not as evident in 1993 and 1994. Of the infauna on mixed-soft beaches, relatively high abundances of nematodes and oligochaetes in Category 3 beaches through 1994 and in Category 2 beaches (especially in 1992) may also represent opportunism. These two meiofaunal taxa ranked one and four in abundance among all infaunal taxa at Category 2 stations in 1992 but have declined in relative importance since.

The long-lived epibiotal community dominants, such as mussels, drills, limpets, and rockweed, known to have suffered heavy losses due to oiling and cleanup, would be expected to be less abundant at Category 2 and 3 sites immediately following the spill. This expectation was realized to a greater degree in 1990 than in 1991; by mid-summer 1991 recovery of many of these dominants had progressed to a greater degree on Category 2 sites than on Category 3 sites. By 1992 recolonization by some of these dominants, most notably limpets (Figure 3-11) and rockweed (Figure 3-5), had more than restored abundances at Category 3 sites; other taxa, such as drills (Figure 3-15) and foliose red algae (Figures 3-18 and 3-24), remained depressed through 1994.

Reduced biological controls (grazing, predation, competition) or altered habitat conditions may cause some species to become more abundant for a time in the post-event assemblage. Reduced grazer populations and perhaps reduced competition for space allowed rockweed at the oiled middle rocky stations (Categories 2 and 3; Figures 3-5 and 3-6) to achieve coverage greater than at the reference stations; this difference persisted into 1993, but was less evident in 1994. This abundance of rockweed, in turn, has influenced recovery of other associated species and may be responsible for the slow recovery of red algae at middle and lower rocky stations (Figure 3-24). Numbers of primary grazers (littorines, Lottiidae; Figures 3-8 and 3-11) are no longer depressed at oiled middle rocky stations. Category differences in density of one of the primary predators in the intertidal zone, *Nucella lamellosa*, had all but disappeared in 1992-93. This difference reappeared in 1994 as populations at Category 1 middle rocky stations increased in apparent response to increases in mussel and barnacle populations. Our expectation is that, over time, the natural balance among predators and prey will become reestablished at Category 2 and 3 sites and that patterns and geographic scale of oscillations will continue to dampen to within the range of natural variability at unaffected sites.

The responses of organisms may be expected to vary between Category 3 and Category 2 sites where differences remain in physical or chemical habitat characteristics that resulted from treatment. For example, recolonization by infauna could be expected to proceed differently on a beach with high residual oil in the sediments from that on a beach where washing had removed some oil, along with fines and organic matter. In some cases, information was not available to develop preconceptions on the expected relationships. Thus, the information on the qualitative patterns must be interpreted separately for each taxon, site category, or variate examined. In cases where the existing data and knowledge do not permit explanation, continued monitoring may clarify the significance (if any) of these patterns.

The statistical testing performed on the 1990 data provided a strong basis to argue that conditions spanning a broad spectrum of biological properties reflected the influence of hydrocarbon contamination on one hand and shoreline treatment on the other; however, the effects of the treatment predominated (Houghton et al. 1991a). Similar testing completed on the 1991, 1992, and 1993 data has provided progressively fewer instances of significant differences between the site categories. Differences between unoiled (Category 1) and oiled but untreated (Category 2) stations have been insignificant since 1991 in most cases. However, several significant differences remain between biological conditions (both infauna and epibiota) at those two station categories and conditions at high-pressure hot-water washed (Category 3) stations. These results—plus trends seen over time in key species abundance, directions of movement seen in principal components and multivariate analyses, and general observations during field cruises—provided strong evidence that recovery was under way, even at the most severely affected sites.

The 1994 data show as many (epibiota at middle rocky stations) or more (infauna) significant category effects in abundance or assemblage measures as did the 1993 data, however. At the least, this suggests that the pace of recovery has slowed considerably. In some cases (epibiota), continuing differences may reflect continuing oscillations in disturbed populations and in the balance of predator-prey relationships. In other cases (infauna), continuing differences may reflect real differences in the habitat conditions at stations within the respective categories. We have some concerns that the Category 3 lower mixed-soft stations have a greater wave exposure than do Category 1 and 2 stations and that this may, in part at least, explain the slow apparent rate of recovery of infauna at these sites.

## EPIBIOTAL ASSEMBLAGES

Analysis of two data sets from shoreline treatment effects studies conducted in 1989 for Exxon showed that major components of the intertidal flora and fauna inhabiting Prince William Sound survived at least three to four months on heavily oiled beaches (Houghton et al. 1990b, Lees and Houghton 1990). Except for a few taxa, these organisms were generally present in abundances comparable to those at unoiled beaches in the sound. Based on these 1989 studies, the short-term effects of the use of high-pressure hot-water on intertidal flora and fauna of the sound were significant: all dominant taxa except barnacles suffered from 60 to 100 percent mortality from treatments of less than three hours' duration.

In the first year of this study (1990; 15 to 17 months following the spill), the effects of 1989 shoreline treatments on intertidal biota remained evident and statistically significant at Category 3 rocky sites; flora and fauna on Category 2 beaches more closely resembled those on Category 1 beaches. The majority of the community dominants were present on Category 2 beaches in abundances similar to those on Category 1 beaches, but reduced numbers of some species (e.g., rockweed, *L. sitkana, Nucella*) at middle elevation stations indicated continued effects from oiling alone (Figures 3-5, 3-8, and 3-15).

In 1990 statistically significant differences (lower abundances) were seen in several of the dominant taxa of epibiota on rocky and mixed-soft (gravel/sand with some cobbles) beaches. Rockweed and limpets (Figure 3-11), both community dominants, most commonly exhibited lower abundances on Category 3 beaches (cf. Category 1 beaches) at middle and upper intertidal elevations. Other species showing significantly lower abundances at these beaches included littorine snails (Figure 3-8), drills (Figure 3-15), and barnacles (Figure 3-14). At lower intertidal levels, effects of hot-water washing were not consistently evident in the epibiota in 1990. Filamentous green algae seem to have been more abundant at Category 2 and 3 stations than at controls; several taxa of red algae showed the opposite pattern at the single Category 3 lower station sampled (Figure 3-24).

By July 1991 substantial recovery had occurred at both Category 2 and Category 3 sites, although significant differences still remained (e.g., in limpet and rockweed abundances at middle rocky stations) between unoiled reference sites and Category 3 sites. Colonization of Category 3 sites by opportunistic species had been substantial, and community composition differed noticeably from that at Category 1 and 2 sites.

By 1992 the majority of the high-pressure hot-water washed beaches appeared, superficially at least, to have recovered. This appearance was due to the proliferation of rockweed at middle rocky stations on Category 2 and 3 beaches, where cover exceeded that on Category 1 beaches (Figure 3-5). This increased cover of rockweed was likely the result of reduced numbers of grazers at Category 2 sites in 1989 and 1990 and at Category 3 sites from 1989 through 1991. By 1992 limpet densities had recovered at oiled middle rocky stations (Figure 3-11), and more normal biological controls were expected to become reestablished in future years. Abundances of some other important species remained altered at Category 3 middle rocky stations from the expected condition as represented by Category 1 middle stations. Hermit crabs, *Littorina sitkana*, *Balanus glandula*, *Semibalanus cariosus*, and some red algae were more abundant in 1992 at Category 1 sites; *L. scutulata*, *Gloiopeltis*, *S. balanoides*, and encrusting brown algae were more abundant at Category 3 sites. This pattern suggested that an earlier stage of ecological succession was still extant at Category 3 middle rocky stations in 1992.

By mid-summer 1993 overall trends indicated continued progress toward recovery with no significant differences in abundant or dominant taxa among categories. Cover of rockweed continued to increase from 1992 levels at Category 2 and 3 middle rocky stations to well above the average cover at Category 1 stations (Figure 3-5). This suggested that the ecological imbalances created by loss of grazers to oiling and treatment continued to affect this assemblage. The Category 3 Block Island and Northwest Bay West Arm middle stations both continued to be heavily dominated by rockweed (> 65 percent cover; Figures 3-6, 3-17), whereas the Northwest Bay Islet middle station (Figure 3-6) remained largely devoid of rockweed and associated biota over about half the sampling transect. Thus, it was expected that the mean rockweed cover at this station would continue to increase as recolonization progressed from its 1993 level (32 percent) towards its pretreatment cover of 79.6 percent. In fact, the limited additional growth of rockweed at the barren shoreward half of this transect in 1994 was offset by reduced cover on the seaward half so that the 1994 cover remained unchanged (30 percent, Figure 3-6).

In 1994 there was a reduction in cover of rockweed at all three elevations sampled on oiled rocky habitats; in contrast, cover at unoiled reference sites increased somewhat. The reduction at oiled sites appeared to be the result of the natural culmination of the life cycle of this species; post-spill and post-treatment colonization by germlings in late 1989 and early 1990 developed to reproductive maturity in 1992 over broad areas of the central sound. Depressed numbers of littorines and limpets (Figures 3-8 and 3-11) allowed this development to proceed with minimal grazing pressure. By 1993 this cohort of rockweed was showing signs of senescence, and numbers of grazers had increased to the point where the decline seen in 1994 was inevitable.

In 1994 littorine densities at oiled upper and middle rocky stations (Figures 3-2 and 3-8) converged with those at unoiled middle stations, a sign of increasing stability. Limpet densities increased at oiled middle stations in 1994 (Figure 3-11), probably in response to the abundance of weakened rockweed plants. Future trends in populations of these grazers will depend on the extent and pattern of the die-back and recolonization of rockweed that occurs in the next few years.

A second predator/prey association at rocky middle intertidal stations, that of the drill (*Nucella* spp.) and its prey (barnacles and mussels), appears to be subject to more dynamic natural fluctuations in Prince William Sound than does the grazer/rockweed association. In contrast to the relative stability of rockweed cover (Figure 3-5) and littorine/limpet densities (Figures 3-8 and 3-11) at Category 1 stations over the years, abundances of mussels, barnacles, and drills have varied much more dramatically. A dense set of mussels that occurred at all middle stations, but especially at Category 1 stations in 1991, has provided prey for expansion of drill populations at these sites for the 1992 through 1994 period (Figure 3-13). A strong set of the opportunistic barnacle *S. balanoides* at Category 1 sites in 1994 supplemented this prey base and led to a sharp increase in drill abundance in 1994 (Figure 3-14). Another demonstration of the cyclic nature of this drill/prey relationship was seen at the Crab Bay rock middle station in 1989: the 3 percent cover of mussels present in April was under attack by drills in June (12.9/0.25 $m^2$), by September 1989, mussel cover was reduced to 0.35 percent and drills were preying predominantly on barnacles. By July of 1990 both mussels and drills were essentially absent at the site; but, by 1993 mussels had again become well established (7.5 percent cover) but had not yet come under significant drill attack (1.1/0.25 $m^2$). In 1994 drill abundance had increased to 8.3/0.25 $m^2$ and mussels were in decline. It is expected that there will be few mussels or drills at this station in 1995.

As defined by Ganning et al. (1984) and endorsed by this study (Houghton et al. 1993a), recovery will be considered to be complete when variability of measured population and assemblage parameters at oiled sites are consistently within the range of natural fluctuations at unoiled sites. Despite the apparent bloom (1991-93) and decline (1994) of rockweed at oiled stations, the trend toward normal (e.g., Category 1) abundance levels for grazers and predators at middle elevation rocky stations suggests that biological controls will become increasingly influential. Because of the wide natural fluctuations in the drill/mussel-barnacle association, it may well be that these components of the intertidal assemblage can be considered recovered at middle rocky stations. At least through 1994, the fluctuations in the grazer/rockweed association appear to be greater at the oiled middle stations than at reference stations; thus, this component of the intertidal assemblage does not appear to have recovered. Again, we expect a gradual damping of oscillations in abundances of dominant species at affected sites over the coming years.

At the single lower elevation rocky station sampled in 1990 through 1993, examination of pretreatment (May 1989) data provides significant insight into the effects of treatment. Washing conducted at this station had no noticeable immediate effect on cover of rockweed (15.4 percent cover in May before treatment, 22.8 percent cover in June after treatment [Figure 3-23]). This apparent lack of effect suggested that temperatures used may have been lower or that wash durations were reduced (by shorter emersion time) from those experienced at the middle elevation station where rockweed was totally removed (Figure 3-6). Impacts of washing on a group of long-lived red algae were severe, however. Cover dropped from more than 70 percent to less than 20 percent cover immediately following the washing (Figure 3-24). During the next four years, cover of rockweed expanded to over 65 percent in 1993 before declining to about 50 percent in 1994. Nonencrusting red algae have not exceeded 20 percent cover since 1989 and recovery to pre-treatment abundance appears unlikely for several more years. Re-establishment of red algae at middle elevations is proceeding more rapidly as evidenced at the paired Northwest Bay West Arm middle rocky stations (Figure 3-18).

Large fluctuations in abundances of limpets and littorine snails at the lower Northwest Bay Islet station have generally been brief, and densities appear to be trending toward the more normal (very low) numbers of these species seen at Category 1 and 2 lower stations (Figures 3-25 and 3-26).

Substantial recovery of most variables characterizing intertidal epibiotal assemblages was apparent in mid-summer 1994. Few differences remained between unoiled rocky stations and stations that were oiled but not treated with high-pressure hot-water washes. Recovery at high-pressure hot-water washed rocky stations, however, continues to lag behind that at oiled but untreated stations both in terms of reduced abundance of some taxa and increased abundance of others.

The clearance of the middle and upper intertidal biota from rocky habitats during hot-water washing was relatively thorough and consistent over scales of 10s or 100s of meters of shoreline. Thus, recolonization by rockweed occurred in synchrony over these same spatial scales resulting in the monoculture of same-aged rockweed plants so evident in 1990 and 1991. The fact that large areas of shoreline have rockweed all of the same age has altered the natural scale of patchiness of rockweed ages. In a natural middle intertidal community, different cohorts of rockweed exist in patches that exist on the scale of decimeters or, at most, meters. Typically, several cohorts from germlings to scenescing plants are represented in any given 0.25-$m^2$ quadrat.

In the natural community, scenescence of any particular cohort does not greatly alter the overall rockweed cover, nor does it greatly impact the several species dependent on the rockweed for food, shelter, or protection from desiccation. The significance of resetting of the intertidal successional clock to zero with the hot-water treatment of large areas of rocky intertidal is becoming more clear as this study progresses.

## INFAUNAL ASSEMBLAGES

Protected sand and gravel beaches were severely affected by hydraulic treatments, which greatly altered beach morphology. Sands and finer gravels were flushed from upper intertidal elevations and often buried the lower beach in several centimeters of sediment that had a relatively low content of fines and organic carbon. Unusual movements of beach sediments were evident at least through 1992 as beach sediments were resorted by wave action to re-establish a stable beach profile. In 1994 significant differences remained in sediment grain size composition between unoiled (Category 1) beaches compared with treated (Category 3) beaches; the percentage of finer materials remained lower at Category 3 beaches. Category 3 beaches were also lowest in nitrogen (Table 4-1) and organic content, an important energy resource for infauna, but these differences were not significant.

Since many of the mixed-soft sites in this study were washed from "landing- craft vehicles" (LCVs) with beach crews using fire hoses, it is probable that organisms on these beaches experienced somewhat lower maximum temperatures than those on beaches washed with omni-barges or maxi-barges (see Houghton et al. 1990a for a discussion of equipment commonly used). Lees et al. (1993) have considered LCV treatment to be "warm-water" rather than "hot-water" washes and note reduced impacts on epibiota from such treatments. For the purposes of this study, all three treatment types have been considered "hot-water" inasmuch as all were capable of heating water to about 60°C.

As discussed at length by Houghton et al. 1993a, the initial impacts of hydraulic treatments on infauna, as well as their effects on recovery of the infaunal community, are probably not dependent solely on temperature. The majority of the initial loss is likely due to suspension or burial, with the thermal buffering of the sediments themselves protecting much of the infauna from thermal effects. Effects of hydraulic treatments on long-term recovery are likewise dependent on the changes in the physical structure of the beach and are thus unrelated to the temperature of the water used. Thus, the authors do not feel that the specific equipment used affects the infaunal results in this study; impacts on infauna would likely be substantial even if cold- (ambient-) water flushes were used.

In 1994 as in previous years, infauna appeared only moderately affected by the spill on Category 2 (oiled but untreated) beaches with no significant differences between Category 1 (unoiled) and Category 2 stations. The trend of increasing diversity, abundance, and richness within the infaunal assemblage at Category 3 lower stations that had been seen from 1990 through 1992 slowed substantially in 1993 and 1994. It is unclear if this leveling off of the recovery signifies a constraint on recovery potential dictated by physical and chemical alterations resulting from treatment, or if it reflects inherent differences in the beaches represented in Category 3. Although it is true that the three Category 3 beaches (Northwest Bay, Shelter Bay, and Sleepy Bay) are somewhat more exposed on average than are Category 1 or 2 beaches, some data suggest that these differences are, at least in part, true impacts of treatment that will simply require an extended period for recovery. For example, the disparity in infaunal abundance and diversity at the Northwest Bay West Arm lower mixed-soft station in side-by-side sampling of treated and untreated areas on April 27, 1989, (Houghton et al. 1994) indicates a much richer assemblage in the oiled beach before treatment; this richer assemblage has yet to become reestablished at this site. The same pattern was seen in pre- and post-treatment densities of hardshell clams on a slightly different portion of that site (Chapter 5). The movement of the Sleepy Bay Category 3 site towards the cluster of Category 1 and 2 lower stations (Figure 4-6) is an encouraging indication of recovery at this station.

## HARDSHELL CLAMS

Within the first few weeks of the spill, toxic effects of oiling on clam populations were evident where thick oil covered their lower beach habitat. At one oiled station where sampling was possible before and after beach washing in spring of 1989, clams surviving the spill were reduced 95.6 percent by dislocation and burial. After that initial period of toxicity, the primary impacts to surviving clams appear to have been from hydraulic washing.

As noted above, washing greatly altered beach morphology as sands and finer gravels were flushed from upper intertidal elevations. Often these sediments would accumulate on the lower beach where dead or dying clams could be found under 20 to 30 cm of fresh sediment. At the same time, washing suspended and dispersed finer sediments including organic matter from the sediment column. The resultant redistribution of sediments often reduced beach stability for several years as wave energy re-sorted beach materials.

Oiled beaches that were hydraulically washed in 1989 consistently showed lower clam recruitment through 1994 compared to that on unoiled beaches and on beaches that were oiled but not washed (Figure 5-1). It is hypothesized that clam (and other infaunal) recruitment was inhibited by the low level of finer sediments and low organic content remaining after washing and experiments were begun in 1994 to test this hypothesis.

Estimated clam densities in large quadrats have been variable but relatively high at oiled but unwashed beaches through 1994 (Figure 5-2). Thus, the flushing of beaches appears to have resulted in very high mortalities of clam populations surviving the oiling; flushing also degraded conditions necessary for recruitment. Given the generally slow growth and substantial longevity of pre-spill littleneck clam populations in unaffected areas of Prince William Sound (mean age of five to six years), it is expected that several more years will be required for full recovery of hardshell clam populations on washed beaches.

# CHAPTER 6

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# ACRONYMS

| | |
|---|---|
| AH | aromatic hydrocarbons |
| ANOVA | analysis of variance |
| C | Celsius |
| cc | cubic centimeter |
| cm | centimeter |
| DCM | dichloromethane |
| g | gram |
| GC | gas chromatography |
| GC-MS | gas chromatography-mass spectrometry |
| GPS | global positioning system |
| H' | diversity |
| IES | Institute for Environmental Studies (LSU) |
| ID | identification |
| km | kilometer |
| KHP | potassium phthalate |
| KOH | potassiumhydroxide |
| LCV | landing -craft vehicle |
| Ln | |
| LSU | Louisiana State University |
| m | meter |
| µl | microliter |
| ml | milliliter |
| MLLW | mean lower low water |
| MS | mass spectrometry |
| N | abundance |
| NOAA | National Oceanic and Atmospheric Administration |
| PAH | polycyclic aromatic hydrocarbon |
| PCA | principal component analyses |
| ppt | parts per thousand |
| QA/QC | quality assurance/quality control |
| RI | recruitment index |
| S | richness |

| | |
|---|---|
| TKN | total Kjeldahl nitrogen |
| TOC | total organic carbon |

# APPENDIX A

## Sampling Effort and Physical Data

**Table A-1 Location, site, station, habitat type, and tidal height for selected sampling - 1989 to 1994.**

| Location and site | Habitat | Station | Tidal ht. (ft) | Epibiota 1/4 m² | Inf. core 1 mm | Mega-Inf. 1/4 m² | Sediment tPAH | Mytilus tissue | Proto. tissue | Grain size | TOC/ TKN | Water qual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Category 1 - Unoiled*** | | | | | | | | | | | | |
| Bass Harbor (NA - 27) | | | | | | | | | | | | |
| Rocky | Rock | Up | 8.83 | 4ABCDFH | | | D | | | | | DH |
| Boulder/cobble | Boulder/cobble | Up | 7.65 | ADF | | | DF | F | | | | |
| | | Mid | 5.37 | AD | | | ABD | ABDH | | | | |
| | | Low | 1.23 | D | | | ABD | | | | | E |
| Outside Bay (NA - 26) | | | | | | | | | | | | |
| Soft 1 | Gravel/cobble | Up | 9.45 | ADF | | | ABDF | | | | | |
| | Gravel/cobble | Mid | 4.90 | ADF | 14ABDF | | ABDF | BGH | | F | F | |
| | Gravel/sand | Low | 0.33 | ABDF | 13ABCDFGH | ADFH | ABCDFG | | DGH | FGH | FGH | DEFGH |
| Soft 2 | Gravel/sand | Mid | | | | | D | ABDF | | | | |
| Eshamy Bay (EB - 7) | | | | | | | | | | | | |
| Rocky | Rock | Up | 9.77 | 4ABDFGH | | | ABDF | D | | | | |
| | Rock | Mid | 5.66 | 1234ABDFGH | | | ABDF | ABDFGH | | | | |
| | Rock | Low | 2.55 | 123BEFGH | | | BF | | | | | EFGH |
| Hogg Bay | | | | | | | | | | | | |
| Rocky | Rock | Up | 9.89 | 4ABCDFH | | | | F | | | | |
| | Rock | Mid | 7.95 | 134ABCDFH | | | BDF | ABDH | | | | |
| | Rock | Low | 2.62 | 13ABDFH | | | ABDF | | | | | CDEFH |
| Sheep Bay | | | | | | | | | | | | |
| Soft | Gravel/sand | Up | 9.72 | ADF | | | ABDF | | | | | |
| | | Mid | 4.55 | ABDF | 4ABDF | | ABDF | ABDFGH | | F | F | |
| | | Low | 2.27 | ABDF | 3ABDFGH | ADFH | ABDFG | | DFGH | FGH | FGH | DF |
| Bainbridge Bight | | | | | | | | | | | | |
| Soft | Gravel/sand | Low | 1.30 | D | CDEFGH | DFH | CDFG | DFG | CFG | EFGH | FGH | CDFH |
| Crab Bay (EV - 500) | | | | | | | | | | | | |
| Rocky | Rock | Mid | 6.90 | 134ABCDFGH | | | BDF | ABDFGH | | | | |
| | Rock | Low | 0.68 | 13ABDFGH | | | BDF | | | | | DEFGH |
| Soft | Gravel/cobble | Up | 9.51 | DF | | | BDF | | | | | |
| | Gravel/cobble | Mid | 5.49 | ADF | ABDF | | ABDF | ABDFGH | | DF | F | |
| | Gravel/cobble | Low | 2.63 | AF | ABFGH | AFH | ABFG | | DFGH | FGH | FGH | F |
| Seward | Boulder/cobble | Mid | | | | | | D | | | | |

*Alpha numeric designation in parentheses are Trustee-Exxon codes for shoreline segment within which the site is located. Numbers and letters under each sample type indicate times when that technique has been applied at the site/station in question: 1=Cruise 1, April 1989; 2=Cruise 2, May 1989; 3=Cruise 3, July 1989; 4=Cruise 4, September 1989; A=July 1990; B=September 1990; C=May 1991; D=July 1991; E=September 1991; F=July 1992; G=July 1993; H=June 1994.

**Table A-1 (continued)**

| Location and site | Habitat | Station | Tidal ht. (ft) | Epibiota 1/4 m² | Inf. core 1 mm | Mega-inf. 1/4 m² | Sediment tPAH | Mytilus tissue | Proto. tissue | Grain size | TOC/ TKN | Water qual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Category 2 - Oiled, untreated**[a] | | | | | | | | | | | | |
| Northwest Bay | | | | | | | | | | | | |
| West Arm Rock | Rock | Mid | 7.83 | 4DFGH | | | | | | | | |
| | Rock | Low | | | | | | | | | | |
| Herring Bay (KN - 5000) | | | | | | | | | | | | |
| Rocky | Rock | Up | 9.64 | 4ABCDFGH | | | DG | | | | | |
| | Rock | Mid | 5.37 | 1234ABCDFGH | | | BDFH | ABDFGH | | | | DFG |
| Soft | Gravel/cobble | Up | 7.21 | ADF | | | BDF | | | | | |
| | Gravel/sand | Low | 0.23 | ACDF | 1234ABCDFGH | ABDFH | BDFG | DFGH | FG | DFGH | FGH | F |
| Bay of Isles (KN - 07) | | | | | | | | | | | | |
| Rocky | Rock | Mid | 4.80 | 134ABD | | | ABD | ABDFH | | | | DF |
| Soft | Gravel/cobble | Up | | AD | | | ABD | | | | | |
| | Gravel/cobble | Low | -0.14 | BD | 134BD | BD | BD | | D | D | | D |
| Snug Harbor (KN - 401) | | | | | | | | | | | | |
| Rocky | Rock | Up | 8.41 | 4ABCDFGH | | | ABDFG | | | | | |
| | Rock | Mid | 5.13 | 234ABCDFGH | | | ABDFG | ABDFGH | | | | |
| | Rock | Low | 1.52 | 23ABDFGH | | | ABDF | | | | | DEFGH |
| Soft | Gravel/cobble | Up | 9.28 | ADF | | | ABDF | | | | | |
| | Gravel/sand | Mid | 5.74 | ACDF | ABDF | | ADF | ADFH | | DF | F | |
| | Gravel/sand | Low | -0.15 | ACDF | 234ABCDFGH | ADFH | ABDFG | G | DFG | DFGH | FGH | F |
| Block Island (EL - 11) | | | | | | | | | | | | |
| Soft | Gravel/sand | Low | 3.59 | ABDF | ABCDFGH | ADFH | BCDFG | FG | CDFGH | DFGH | FGH | FH |
| Mussel Beach South | | | | | | | | | | | | |
| Soft | Gravel/sand | Mid | 4.40 | ABDF | BDF | | ABDF | ABDFH | | DF | F | |
| | Gravel/sand | Low | -0.89 | ACDF | 234ADFGH | ADFH | ADFG | G | FGH | DFGH | FGH | DFH |
| Crafton Island (CR - 5) | | | | | | | | | | | | |
| Soft | Gravel/cobble | Up | 8.52 | AD | | | ABDF | | | | | |
| | Gravel/cobble | Mid | 5.01 | AD | D | | ABDF | ABDFH | | D | | |
| | Gravel/cobble | Low | 2.95 | AD | ABDG | ABD | ABDFG | G | G | DG | G | DEF |

[a]Alpha numeric designation in parentheses are Trustee-Exxon codes for shoreline segment within which the site is located. Numbers and letters under each sample type indicate times when that technique has been applied at the site/station in question: 1=Cruise 1, April 1989; 2=Cruise 2, May 1989; 3=Cruise 3, July 1989; 4=Cruise 4, September 1989; A=July 1990; B=September 1990; C=May 1991; D=July 1991; E=September 1991; F=July 1992; G=July 1993; H=June 1994.

## Table A-1 (continued)

| Location and site | Habitat | Station | Tidal ht. (ft) | Epibiota 1/4 m² | Inf. core 1 mm | Mega-inf. 1/4 m² | Sediment tPAH | Mytilus tissue | Proto. tissue | Grain size | TOC/ TKN | Water qual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Category 2 - Oiled, untreated*** | | | | | | | | | | | | |
| Outside Bay (NA - 26) | | | | | | | | | | | | |
| Rocky | Rock | Up | 8.96 | 4ABCDFGH | | | ABF | | | | | |
| | Rock | Mid | 5.27 | 134ABCDFGH | | | F | | | | | |
| | Rock | Low | 0.70 | 13ABCDFGH | | | BDF | | | | | CDF |
| Ingot Island (IN - 24) | | | | | | | | | | | | |
| Boulder/cobble | Rock/boulder | Mid | 6.80 | BD | | | BDF | BDFH | | | | |
| Soft | Gravel/cobble | Low | 2.33 | DF | BDFG | BDF | BDFG | G | DG | DFG | FG | E |
| **Category 3 - Oiled, treated*** | | | | | | | | | | | | |
| Point Helen (KN - 405) Site 1 | | | | | | | | | | | | |
| Boulder/cobble | Boulder/cobble | Up | 7.25 | AD | | | F | | | | | |
| | Boulder/cobble | Mid | 4.16 | DF | | | ABDF | ABDF | | | | |
| | Boulder/cobble | Low | -1.46 | AD | | | BDF | | | | | DEF |
| Point Helen (KN - 405) Site 3 | | | | | | | | | | | | |
| Boulder/cobble | Boulder/cobble | Up | 7.25 | F | | | | | | | | |
| | Boulder/cobble | Mid | 4.16 | F | | | | | | | | |
| | Boulder/cobble | Low | -1.40 | F | | | | | | | | |
| Northwest Bay | | | | | | | | | | | | |
| Rocky Islet (EL - 55) | Rock | Up | 9.42 | 4ABCDFH | | | ADFG | | | | | |
| | Rock | Mid | 6.97 | 1234ABCDFGH | | | ABDFGH | ABDFGH | | | | |
| | Rock | Low | 2.46 | 234ABCDFGH | | | ABDFG | | | | | DEFGH |
| West Arm Rock | Rock | Mid | 7.83 | 4ADFGH | | | | | | | | FG |
| | Rock | Low | | | | | | | | | | |
| W. Arm Soft (EL - 52) | Gravel/cobble | Mid | 6.20 | ABDFH | BDF | | ABDF | ABDFH | | DF | F | |
| | Gravel/sand | Low | 0.63 | ABDFH | 23ABCDFGH | ADFH | ABCDFG | G | DFGH | DFGH | FGH | |
| Shelter Bay (EV - 21) | | | | | | | | | | | | |
| Soft | Gravel/sand | Up | 8.57 | BDF | | | DF | | | | | |
| | Gravel/sand | Mid | 6.18 | ADF | 4ABDF | | ABDF | ABDFG | | DF | F | |
| | Gravel/sand | Low | 1.02 | ABDF | 234ABCDFGH | ADFH | ABCDFG | | DFGH | DFGH | FGH | DF |

*Alpha numeric designation in parentheses are Trustee-Exxon codes for shoreline segment within which the site is located. Numbers and letters under each sample type indicate times when that technique has been applied at the site/station in question: 1=Cruise 1, April 1989; 2=Cruise 2, May 1989; 3=Cruise 3, July 1989; 4=Cruise 4, September 1989; A=July 1990; B=September 1990; C=May 1991; D=July 1991; E=September 1991; F=July 1992; G=July 1993; H=June 1994.

**Table A-1 (continued)**

| Location and site | Habitat | Station | Tidal ht. (ft) | Epibiota 1/4 m² | Inf. core 1 mm | Mega-inf. 1/4 m² | Sediment tPAH | Mytilus tissue | Proto. tissue | Grain size | TOC/ TKN | Water qual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Category 3 - Oiled, treated*** | | | | | | | | | | | | |
| Sleepy Bay (LA - 18) | | | | | | | | | | | | |
| Soft | Gravel/cobble | Up | 3.56 | ADF | AB | | ABDF | | | | | |
| | Gravel/sand | Mid | 1.48 | ADF | ABDF | | ABDF | ABDFGH | | DF | F | |
| | Gravel/sand | Low | -0.85 | DF | DFGH | DFH | DFG | | DF | DFGH | FGH | F |
| Ne Latouche Cobble (LA - 15) | | | | | | | | | | | | |
| Boulder/cobble | Boulder/cobble | Mid | 3.19 | ADF | | | ABDF | ABDFH | | | | D |
| | Boulder/cobble | Low | 0.71 | BDF | | | BF | | | | | F |
| Smith Island (SM - 06) | | | | | | | | | | | | |
| Boulder/cobble | Boulder/cobble | Up | 8.35 | BD | | | BD | | | | | |
| N - 4 | Boulder/cobble | Mid | 6.35 | ABD | | | ABD | ABDGH | | | | |
| | Boulder/cobble | Low | 2.14 | ABD | | | ABD | | | | | DEFG |
| Mussel Beach South (EL - 13) | | | | | | | | | | | | |
| Rocky | Rock | Up | | 4ABCDFGH | | | DF | | | | | D |
| Mussel Beach North (EL - 13) | | | | | | | | | | | | |
| Rocky | Rock | Up | 10.75 | FGH | | | | | | | | |
| | Rock | Mid | 5.57 | FGH | | | | | | | | |
| | Rock | Mid(ABC) | | F | | | | | | | | |
| | Rock | Low | 2.40 | FGH | | | | | | | | F |
| Omni Site | | | | | | | | | | | | |
| Boulder/cobble | Rock/boulder | Mid | 4.87 | FH | | | F | F | | | | |
| Block Island (EL - 11) | | | | | | | | | | | | |
| Rocky | Rock | Up | 8.27 | CDFGH | | | | | | | | |
| | Rock | Mid | 3.82 | ABCDFGH | | | A | ABDFGH | | F | | CDGH |
| Soft | Gravel/sand | Mid | 6.49 | ADF | BF | A | ABDFH | BGH | | | F | |

*Alpha numeric designation in parentheses are Trustee-Exxon codes for shoreline segment within which the site is located. Numbers and letters under each sample type indicate times when that technique has been applied at the site/station in question: 1=Cruise 1, April 1989; 2=Cruise 2, May 1989; 3=Cruise 3, July 1989; 4=Cruise 4, September 1989; A=July 1990; B=September 1990; C=May 1991; D=July 1991; E=September 1991; F=July 1992; G=July 1993; H=June 1994.

**Table A-1 (continued)**

| Location and site | Habitat | Station | Tidal ht. (ft) | Epibiota 1/4 m² | Inf. core 1 mm | Mega-inf. 1/4 m² | Sediment tPAH | Mytilus tissue | Proto. tissue | Grain size | TOC/ TKN | Water qual. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Category 3 - Oiled, treated[a]** | | | | | | | | | | | | |
| Elrington Island West | | | | | | | | | | | | |
| Rocky | Rock | Up | | | | | F | | | | | |
| | Rock | Mid | | 4FH | | | F | F | | | | |
| | Rock | Low | 3.75 | FH | | | F | | | | | F |
| Soft | Gravel/sand | Mid | | | | | F | | | | | |
| | Gravel/sand | Low | 1.79 | | FGH | FH | FG | G | FGH | FGH | FGH | |
| Elrington Island East | | | | | | | | | | | | |
| Rocky | Rock | Up | | FH | | | F | | | | | |
| | Rock | Mid | | 4FH | | | F | | | | | |
| | Rock | Low | 2.32 | FH | | | | | | | | |
| Soft | Gravel/sand | Mid | | | | | F | F | | | | |
| | Gravel/sand | Low | | | | | F | | F | | | |
| Elrington Islet - East | Rock | Up | 8.04 | FH | | | | | | | | |
| Elrington Islet - West | Rock | Up | 8.10 | FH | | | | | | | | H |
| Elrington Islet - North | Rock | Up | 8.00 | FH | | | | | | | | |

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[a]Alpha numeric designation in parentheses are Trustee-Exxon codes for shoreline segment within which the site is located. Numbers and letters under each sample type indicate times when that technique has been applied at the site/station in question: 1=Cruise 1, April 1989; 2=Cruise 2, May 1989; 3=Cruise 3, July 1989; 4=Cruise 4, September 1989; A=July 1990; B=September 1990; C=May 1991; D=July 1991; E=September 1991; F=July 1992; G=July 1993; H=June 1994.

**Table A-2 Water temperature (°C) and salinity (ppt) at sampling sites in Prince William Sound, June 1994.**

| Location and category | Habitat | Depth | Date | Temperature | Salinity |
|---|---|---|---|---|---|
| **Category 1 - Unoiled** | | | | | |
| Bass Harbor | Rock | 0.3 m | 6/29/94 | 11.2 | 28.1 |
| | | 2.4 m | 6/29/94 | 9.8 | 29.0 |
| Outside Bay | Soft | 0.3 m | 6/21/94 | 10.5 | 28.2 |
| | | 2.4 m | 6/21/94 | 8.0 | 30.8 |
| Eshamy Bay | Rock | 0.3 m | 6/28/94 | 11.8 | 24.2 |
| | | 2.4 m | 6/28/94 | 11.5 | 25.6 |
| Hogg Bay | Rock | 0.3 m | 6/26/94 | 11.0 | 25.9 |
| | | 2.4 m | 6/26/94 | 9.1 | 29.1 |
| Bainbridge Bight | Soft | 0.3 m | 6/26/94 | 7.2 | 29.5 |
| | | 2.4 m | 6/26/94 | 7.2 | 28.5 |
| Crab Bay | Rock | 0.3 m | 6/24/94 | 10.1 | 28.0 |
| | | 2.4 m | 6/24/94 | 9.9 | 28.3 |
| **Category 2 - Oiled, untreated** | | | | | |
| Block Island/Mussel Beach | Rock/Soft | 0.3 m | 6/20/94 | 12.4 | 25.2 |
| | | 2.4 m | 6/20/94 | 10.8 | 27.2 |
| Snug Harbor | Rock/Soft | 0.3 m | 6/23/94 | 13.2 | 25.5 |
| | | 2.4 m | 6/23/94 | 10.1 | 29.1 |
| **Category 3 - Oiled, treated** | | | | | |
| Northwest Bay Islet/W Arm | Rock/Soft | 0.3 m | 6/22/94 | 11.0 | 27.2 |
| | | 1.8 m | 6/22/94 | 10.0 | 28.1 |
| Elrington Island West | Rock | 0.3 m | 6/25/94 | 11.2 | 27.1 |
| | | 2.4 m | 6/25/94 | 10.1 | 27.8 |

**Table A-3 Grain size analysis raw data by location, low mixed-soft, June 1994 (data presented as percent of total displacement volume for each size fraction).**

| | Size fraction | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Category and location | 12.5 mm | 6.3 mm | 2.0 mm | 1.0 mm | 500 μ | 250 μ | 125 μ | 63 μ | Silt/clay |
| **Category 1 - Unoiled** | | | | | | | | | |
| Bainbridge Bight | 31.25 | 11.11 | 12.73 | 5.44 | 16.20 | 13.89 | 2.55 | 2.20 | 4.63 |
| Crab Bay | 11.36 | 9.09 | 21.59 | 15.68 | 9.66 | 10.23 | 3.07 | 3.41 | 15.91 |
| Outside Bay | 22.32 | 21.25 | 11.69 | 17.00 | 1.59 | 13.82 | 3.93 | 2.87 | 5.53 |
| Sheep Bay | 12.78 | 6.83 | 11.71 | 6.24 | 26.83 | 15.61 | 4.88 | 4.39 | 10.73 |
| **Category 2 - Oiled, untreated** | | | | | | | | | |
| Herring Bay | 28.53 | 13.99 | 17.22 | 5.27 | 7.21 | 11.30 | 3.44 | 2.48 | 10.55 |
| Block Island | 28.11 | 13.58 | 26.32 | 18.95 | 3.89 | 5.68 | 1.16 | 0.53 | 1.79 |
| Mussel Beach South | 32.38 | 10.54 | 23.95 | 12.45 | 7.47 | 8.43 | 1.82 | 0.96 | 2.01 |
| Snug Harbor | 51.53 | 11.44 | 13.56 | 4.36 | 5.54 | 4.72 | 3.66 | 3.66 | 1.53 |
| **Category 3 - Oiled, treated** | | | | | | | | | |
| NW Bay West Arm | 33.81 | 21.25 | 29.72 | 7.46 | 2.15 | 0.72 | 1.74 | 1.33 | 1.84 |
| Shelter Bay | 30.20 | 19.07 | 33.38 | 8.11 | 5.72 | 2.23 | 0.79 | 0.08 | 0.41 |
| Sleepy Bay | 11.81 | 11.35 | 39.36 | 22.46 | 6.95 | 4.86 | 2.08 | 0.69 | 0.44 |
| Elrington Island West | 28.63 | 20.73 | 15.79 | 1.18 | 5.03 | 14.81 | 3.85 | 0.69 | 9.28 |
| **Clam transplant experiment** | | | | | | | | | |
| NW Bay/Block Is. sediment mix | 19.58 | 11.64 | 20.37 | 10.05 | 6.61 | 11.38 | 8.73 | 6.61 | 5.03 |
| NW Bay transplant sediment | 17.66 | 15.49 | 35.33 | 11.14 | 9.78 | 4.35 | 2.72 | 2.45 | 1.09 |

# Appendix B

# Epibiota Data

**Table B-1-1 Quality control results from rocky middle intertidal epibiota, June 1994.**

| | Block Island | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Quad 1 | | | | | | Quad 2 | | | | | |
| | SL | DCL | JPH | % Change | | | AKF | JPH | DCL | % Change | | |
| Taxon | q1 | q1 | q1 | SL vs DCL | SL vs JPH | Mean | q2 | q2 | q2 | AKF vs JPH | AKF vs DCL | Mean |
| *Blidingia minima* | 0 | 0 | 0 | - | - | - | 0 | 0 | 0 | - | - | - |
| *Chaetomorpha tortuosa* | 0 | 0 | 0 | - | - | - | 0 | 0 | 0 | - | - | - |
| *Cladophora sericea* | 0 | 0 | 0 | - | - | - | 0 | 0 | 0 | - | - | - |
| *Elachista fucicola* | 0 | 0 | 0 | - | - | - | 0 | 0 | 0 | - | - | - |
| *Fucus gardneri* | 30 | 20 | 18 | -33 | -40 | -37 | 55 | 30 | 45 | -45 | -18 | -32 |
| *Fucus gardneri* (germlings) | 2 | 1 | 3 | -50 | 50 | 0 | 5 | 5 | 2 | 0 | -60 | -30 |
| *Gloiopeltis furcata* | 0.5 | 0.5 | 0.5 | 0 | 0 | 0 | 0.5 | 0.5 | 0.5 | 0 | 0 | 0 |
| *Halosaccion glandiforme* | 0 | 0 | 0 | - | - | - | 0 | 0 | 0 | - | - | - |
| *Hildenbrandia rubra* | 0.5 | 0.5 | 1 | 0 | 100 | 50 | 1 | 4 | 1 | 300 | 0 | 150 |
| *Mastocarpus papillatus* | 0.5 | 0 | 0 | -100 | -100 | -100 | 0 | 0 | 0 | - | - | - |
| *Mazzaella* spp. | 0 | 0.5 | 0.5 | - | - | - | 0 | 0.5 | 0.5 | - | - | - |
| *Melanosiphon intestinalis* | 0 | 0 | 0 | - | - | - | 0 | 0.5 | 0.5 | - | - | - |
| *Monostroma grevillei* | 0 | 0 | 0 | - | - | - | 0 | 0 | 0 | - | - | - |
| *Neorhodomela oregona* | 0 | 0.5 | 0.5 | - | - | - | 0.5 | 0 | 0.5 | -100 | 0 | -50 |
| *Pilayella littoralis* | 0 | 0 | 0 | - | - | - | 0 | 0 | 0 | - | - | - |
| *Verrucaria* spp. | 0 | 0 | 0 | - | - | - | 0 | 0 | 0 | - | - | - |
| **Total Fucus** | **32** | **21** | **21** | **-34** | **-34** | **-34** | **60** | **35** | **47** | **-42** | **-22** | **-32** |
| **Total Algal Cover** | **34** | **23.5** | **24** | **-31** | **-29** | **-30** | **62.5** | **40.5** | **50.5** | **-35** | **-19** | **-27** |
| | | | | | | | | | | | | |
| *Balanus glandula* (%) | 2 | 2 | 3 | 0 | 50 | 25 | 0.5 | 2 | 2 | 300 | 300 | 300 |
| *Balanus/Semibalanus* s pp., set | 0.5 | 0 | 0 | -100 | -100 | -100 | 0.5 | 0.5 | 0.5 | 0 | 0 | 0 |
| *Chthamalus dalli* (% set) | 0 | 0.5 | 0 | - | - | - | 0 | 0.5 | 0.5 | - | - | - |
| *Chthamalus dalli* (%) | 0 | 0 | 0 | - | - | - | 0 | 0 | 0 | - | - | - |
| *Mytilus* sp. (% spat) | 0 | 0.5 | 0.5 | - | - | - | 0 | 0 | 0 | - | - | - |
| *Mytilus* c f. *trossulus* (%) | 7 | 10 | 10 | 43 | 43 | 43 | 25 | 25 | 20 | 0 | -20 | -10 |
| *Semibalanus balanoides* (% set) | 0 | 0.5 | 0.5 | - | - | - | 0 | 2 | 0.5 | - | - | - |
| *Semibalanus balanoides* (%) | 6 | 8 | 7 | 33 | 17 | 25 | 6 | 6 | 5 | 0 | -17 | -8 |
| Spirorbidae, unid. (%) | 0 | 0 | 0 | - | - | - | 0 | 0 | 0 | - | - | - |
| **Balanomorpha Subtotal** | **8.5** | **11** | **10.5** | **29** | **24** | **26** | **7** | **11** | **8.5** | **57** | **21** | **39** |
| **Mussel Subtotal** | **7** | **10.5** | **10.5** | **50** | **50** | **50** | **25** | **25** | **20** | **0** | **-20** | **-10** |
| **Total Animal Cover** | **15.5** | **21.5** | **21** | **39** | **35** | **37** | **32** | **36** | **28.5** | **13** | **-11** | **1** |
| | | | | | | | | | | | | |
| *Evasterias troschelii* | 0 | 0 | 0 | - | - | - | 0 | 0 | 0 | - | - | - |
| Gammaridea, unid. | 0 | 0 | 0 | - | - | - | 0 | 0 | 0 | - | - | - |
| *Hemigrapsus oregonensis* | 0 | 0 | 0 | - | - | - | 0 | 0 | 1 | - | - | - |
| *Leptasterias hexactis* | 0 | 0 | 0 | - | - | - | 0 | 0 | 0 | - | - | - |
| *Littorina scutulata* | 20 | 14 | 14 | -30 | -30 | -30 | 45 | 76 | 52 | 69 | 16 | 42 |
| *Littorina sitkana* | 42 | 33 | 50 | -21 | 19 | -1 | 87 | 70 | 51 | -20 | -41 | -30 |
| *Lottia pelta* | 3 | 0 | 2 | -100 | -33 | -67 | 1 | 6 | 0 | 500 | -100 | 200 |
| Lottiidae, unid. | 28 | 46 | 42 | 64 | 50 | 57 | 32 | 41 | 41 | 28 | 28 | 28 |
| Lottiidae, unid. (juv.) | 0 | 0 | 0 | - | - | - | 0 | 0 | 0 | - | - | - |

**Table B-1-1 (continued)**

| | Block Island | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Quad 1 | | | | | | Quad 2 | | | | | |
| | SL | DCL | JPH | % Change | | | AKF | JPH | DCL | % Change | | |
| Taxon | q1 | q1 | q1 | SL vs DCL | SL vs JPH | Mean | q2 | q2 | q2 | AKF vs JPH | AKF vs DCL | Mean |
| *Notoplana* sp. | 0 | 0 | 0 | - | - | - | 0 | 1 | 0 | - | - | - |
| *Nucella lamellosa* | 0 | 0 | 0 | - | - | - | 0 | 0 | 0 | - | - | - |
| *Pagurus hirsutiusculus* | 1 | 0 | 1 | -100 | 0 | -50 | 12 | 14 | 12 | 17 | 0 | 8 |
| *Tectura scutum* | 1 | 0 | 3 | -100 | 200 | 50 | 0 | 0 | 0 | - | - | - |
| **Total Lottiidae** | **32** | **46** | **47** | **44** | **47** | **45** | **33** | **47** | **41** | **42** | **24** | **33** |
| **Total Animals Counted** | **95** | **93** | **112** | **-2** | **18** | **8** | **177** | **208** | **157** | **18** | **-11** | **3** |
| | | | | | | | | | | | | |
| *Fucus gardneri* (dead) | 0 | 0 | 0.5 | - | - | - | 0 | 0 | 0.5 | - | - | - |
| | | | | | | | | | | | | |
| *Balanus glandula* (% dead) | 0 | 0 | 0 | - | - | - | 0.5 | 0 | 0 | -100 | -100 | -100 |
| *Chthamalus dalli* (% dead) | 0 | 0 | 0 | - | - | - | 0 | 0 | 0 | - | - | - |
| *Mytilus* cf. *trossulus (dead)* | 4 | 5 | 6 | 25 | 50 | 38 | 9 | 14 | 6 | 56 | -33 | 11 |
| *Semibalanus balanoides* (% dea | 3 | 6 | 3 | 100 | 0 | 50 | 0 | 0.5 | 0.5 | - | - | - |
| | | | | | | | | | | | | |
| Boulder/cobble (%) | 0 | 0 | 0 | - | - | - | 0 | 0 | 0 | - | - | - |
| Gravel/sand(%) | 0 | 0 | 0 | - | - | - | 0 | 0 | 0 | - | - | - |
| Rock (%) | 100 | 100 | 100 | 0 | 0 | 0 | 100 | 100 | 100 | 0 | 0 | 0 |
| Water (%) | 0 | 0 | 0 | - | - | - | 0 | 5 | 7 | - | - | - |

**Table B-1-1 (continued).**

| | Eshamy Bay | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Quad 3 | | | Quad 6 | | | Quad 8 | | | Quad 9 | | |
| | AKF | DCL | % Change | SL | AKF | % Change | JPH | SL | % Change | AKF | JPH | % Change |
| Taxon | q43 | q43 | AKF vs DCL | q46 | q46 | SL vs AKF | q48 | q48 | JPH vs SL | q49 | q49 | AKF vs JPH |
| *Blidingia minima* | 0 | 0 | - | 0 | 0 | - | 0 | 0 | - | 2 | 2 | 0 |
| *Chaetomorpha tortuosa* | 0 | 0 | - | 3 | 1 | -67 | 2 | 1 | -50 | 0 | 0 | - |
| *Cladophora sericea* | 0.5 | 0.5 | 0 | 3 | 5 | 67 | 2 | 0.5 | -75 | 0 | 0 | - |
| *Elachista fucicola* | 0 | 0 | - | 0 | 0 | - | 0 | 0 | - | 0 | 1 | - |
| *Fucus gardneri* | 40 | 35 | -13 | 10 | 15 | 50 | 2 | 1 | -50 | 15 | 12 | -20 |
| *Fucus gardneri* (germlings) | 0.5 | 0.5 | 0 | 1 | 1 | 0 | 2 | 0.5 | -75 | 2 | 5 | 150 |
| *Gloiopeltis furcata* | 1 | 0.5 | -50 | 1 | 1 | 0 | 5 | 2 | -60 | 2 | 0 | -100 |
| *Halosaccion glandiforme* | 0 | 0 | - | 0 | 0 | - | 0 | 0 | - | 0.5 | 0 | -100 |
| *Hildenbrandia rubra* | 0 | 0 | - | 0 | 0 | - | 0 | 0 | - | 0 | 0 | - |
| *Mastocarpus papillatus* | 0 | 0.5 | - | 0 | 0 | - | 0 | 0 | - | 0 | 0 | - |
| *Mazzaella* spp | 0 | 0 | - | 0 | 0 | - | 0 | 0 | - | 0 | 0 | - |
| *Melanosiphon intestinalis* | 0 | 0 | - | 0.5 | 0.5 | 0 | 0 | 0 | - | 0 | 0 | - |
| *Monostroma grevillei* | 0 | 0.5 | - | 0 | 0 | - | 0 | 0 | - | 0 | 0 | - |
| *Neorhodomela oregona* | 0.5 | 0.5 | 0 | 0 | 0.5 | - | 0 | 0 | - | 0 | 0 | - |
| *Pilayella littoralis* | 4 | 3 | -25 | 0 | 0 | - | 0 | 0 | - | 2 | 1 | -50 |
| *Verrucaria* spp. | 0 | 0 | - | 0 | 20 | - | 0 | 0 | - | 0 | 0 | - |
| **Total Fucus** | **40.5** | **35.5** | **-12** | **11** | **16** | **45** | **4** | **1.5** | **-63** | **17** | **17** | **0** |
| **Total Algal Cover** | **46.5** | **41** | **-12** | **18.5** | **44** | **138** | **13** | **5.5** | **-58** | **23.5** | **21** | **-11** |
| | | | | | | | | | | | | |
| *Balanus glandula* (%) | 0 | 0 | - | 0 | 0.5 | - | 1 | 0.5 | -50 | 0.5 | 0 | -100 |
| *Balanus/Semibalanus* s pp., set | 0 | 0 | - | 0 | 0.5 | - | 0.5 | 0.5 | 0 | 6 | 0 | -100 |
| *Chthamalus dalli* (% set) | 0 | 0 | - | 0 | 0 | - | 0 | 0 | - | 0.5 | 0 | -100 |
| *Chthamalus dalli* (%) | 0.5 | 0.5 | 0 | 0.5 | 0.5 | 0 | 1 | 0.5 | -50 | 5 | 5 | 0 |
| *Mytilus sp.* (% spat) | 0 | 0 | - | 0 | 0 | - | 0 | 0.5 | - | 0 | 0 | - |
| *Mytilus cf. trossulus* ( %) | 0 | 0 | - | 0 | 0 | - | 60 | 35 | -42 | 0 | 0 | - |
| *Semibalanus balanoides* (% set) | 0 | 0 | - | 0 | 0 | - | 0.5 | 0 | -100 | 0 | 12 | - |
| *Semibalanus balanoides* ( %) | 0 | 0 | - | 0 | 0 | - | 0.5 | 0.5 | 0 | 0 | 0.5 | - |
| Spirorbidae, unid. (%) | 0 | 0 | - | 0 | 0 | - | 0 | 0 | - | 0.5 | 0 | -100 |
| **Balanomorpha Subtotal** | **0.5** | **0.5** | **0** | **0.5** | **1.5** | **200** | **3.5** | **2** | **-43** | **12** | **17.5** | **46** |
| **Mussel Subtotal** | **0** | **0** | **-** | **0** | **0** | **-** | **60** | **35.5** | **-41** | **0** | **0** | **-** |
| **Total Animal Cover** | **0.5** | **0.5** | **0** | **0.5** | **1.5** | **200** | **63.5** | **37.5** | **-41** | **12.5** | **17.5** | **40** |
| | | | | | | | | | | | | |
| *Evasterias troschelii* | 0 | 1 | - | 0 | 0 | - | 0 | 0 | - | 0 | 0 | - |
| Gammaridea, unid. | 0 | 0 | - | 0 | P | - | 0 | 0 | - | 0 | 0 | - |
| *Hemigrapsus oregonensis* | 0 | 0 | - | 0 | 0 | - | 0 | 0 | - | 0 | 0 | - |
| *Leptasterias hexactis* | 1 | 0 | -100 | 0 | 0 | - | 0 | 0 | - | 0 | 0 | - |
| *Littorina scutulata* | 12 | 19 | 58 | 98 | 135 | 38 | 160 | 106 | -34 | 5 | 0 | -100 |
| *Littorina sitkana* | 14 | 11 | -21 | 8 | 14 | 75 | 5 | 5 | 0 | 0 | 0 | - |
| *Lottia pelta* | 0 | 0 | - | 3 | 0 | -100 | 0 | 0 | - | 0 | 2 | - |
| Lottiidae, unid. | 4 | 1 | -75 | 0 | 55 | - | 0 | 0 | - | 4 | 0 | -100 |
| Lottiidae, unid. (juv.) | 2 | 5 | 150 | 32 | 0 | -100 | 15 | 9 | -40 | 1 | 8 | 700 |

Table B-1-1 (continued).

| | Eshamy Bay | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Quad 3 | | | Quad 6 | | | Quad 8 | | | Quad 9 | | |
| | AKF | DCL | % Change | SL | AKF | % Change | JPH | SL | % Change | AKF | JPH | % Change |
| Taxon | q43 | q43 | AKF vs DCL | q46 | q46 | SL vs AKF | q48 | q48 | JPH vs SL | q49 | q49 | AKF vs JPH |
| *Notoplana* sp. | 0 | 0 | - | 0 | 0 | - | 0 | 0 | - | 0 | 0 | - |
| *Nucella lamellosa* | 8 | 14 | 75 | 11 | 16 | 45 | 0 | 0 | - | 0 | 0 | - |
| *Pagurus hirsutiusculus* | 17 | 27 | 59 | 0 | 18 | - | 1 | 1 | 0 | 1 | 0 | -100 |
| *Tectura scutum* | 0 | 0 | - | 0 | 0 | - | 1 | 0 | -100 | 0 | 1 | - |
| **Total Lottiidae** | 6 | 6 | 0 | 35 | 55 | 57 | 16 | 9 | -44 | 5 | 11 | 120 |
| **Total Animals Counted** | 58 | 78 | 34 | 152 | 238 | 57 | 182 | 121 | -34 | 11 | 11 | 0 |
| | | | | | | | | | | | | |
| *Fucus gardneri* (dead) | 0 | 0.5 | - | 0 | 0 | - | 0 | 0 | - | 0 | 0 | - |
| | | | | | | | | | | | | |
| *Balanus glandula* ( % dead) | 0.5 | 0.5 | 0 | 2 | 0.5 | -75 | 0 | 0.5 | - | 0.5 | 0 | -100 |
| *Chthamalus dalli* (% dead) | 0.5 | 0.5 | 0 | 0.5 | 0.5 | 0 | 0 | 0 | - | 1 | 0.5 | -50 |
| *Mytilus cf. trossulus* (dead) | 0 | 12 | - | 17 | 4 | -76 | 12 | 26 | 117 | 0 | 0 | - |
| *Semibalanus balanoides* (% dea | 0 | 0 | - | 0 | 0 | - | 0 | 0 | - | 0 | 0 | - |
| | | | | | | | | | | | | |
| Boulder/cobble (%) | 65 | 55 | -15 | 18 | 20 | 11 | 40 | 65 | 63 | 100 | 100 | 0 |
| Gravel/sand(%) | 5 | 5 | 0 | 2 | 0 | -100 | 55 | 35 | -36 | 0 | 0 | - |
| Rock (%) | 30 | 40 | 33 | 80 | 80 | 0 | 5 | 0 | -100 | 0 | 0 | - |
| Water (%) | 0 | 0 | - | 0 | 0 | - | 0 | 0 | - | 0 | 0 | - |

**Table B-1-2 Rocky upper intertidal epibiota, June 1994.**

| Taxon | Bass Harbor | | | Block Island | | | Elrington Islet E. | | | Elrington Islet N. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count |
| Black crust (maybe *Hildenbrandia rubra* ) | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 1.70 | 2.22 | 5 |
| *Blidingia minima* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 1.60 | 3.03 | 5 | 4.80 | 6.01 | 5 |
| Blue-green algae, spheroids | 0.00 | 0.00 | 5 | 0.10 | 0.22 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| Bryophyta, unid. | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Cladophora sericea* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.10 | 0.22 | 5 |
| *Endocladia muricata* | 0.10 | 0.22 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| Endozoic green algae | 1.00 | 0.61 | 5 | 0.40 | 0.22 | 5 | 0.20 | 0.27 | 5 | 0.10 | 0.22 | 5 |
| *Fucus gardneri* | 0.80 | 1.30 | 5 | 20.30 | 25.50 | 5 | 0.00 | 0.00 | 5 | 5.10 | 6.99 | 5 |
| *Fucus gardneri* (germlings) | 0.40 | 0.42 | 5 | 0.40 | 0.22 | 5 | 0.30 | 0.27 | 5 | 0.30 | 0.27 | 5 |
| *Gloiopeltis furcata* | 3.30 | 2.22 | 5 | 0.10 | 0.22 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.27 | 5 |
| *Halosaccion glandiforme* | 0.10 | 0.22 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Hildenbrandia rubra* | 1.40 | 2.01 | 5 | 3.70 | 4.06 | 5 | 0.50 | 0.00 | 5 | 9.10 | 10.74 | 5 |
| *Mastocarpus papillatus* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Mazzaella spp.* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Melanosiphon intestinalis* | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Neorhodomela oregona* | 0.40 | 0.89 | 5 | 0.10 | 0.22 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Porphyra* spp. | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Ralfsia fungiformis* | 0.00 | 0.00 | 5 | 0.10 | 0.22 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Ralfsia* spp. | 0.00 | 0.00 | 5 | 2.80 | 5.22 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Soranthera ulvoidea* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.10 | 0.22 | 5 |
| *Ulva/Ulvaria* spp. | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Verrucaria* spp. | 0.00 | 0.00 | 5 | 20.30 | 29.54 | 5 | 0.20 | 0.45 | 5 | 19.00 | 21.33 | 5 |
| | | | | | | | | | | | | |
| *Balanus glandula* (% set) | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 11.00 | 6.08 | 5 |
| *Balanus glandula* (%) | 1.20 | 0.76 | 5 | 0.40 | 0.42 | 5 | 1.20 | 0.76 | 5 | 11.00 | 6.08 | 5 |
| *Balanus/Semibalanus* spp., set (%) | 0.10 | 0.22 | 5 | 0.10 | 0.22 | 5 | 0.50 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Chthamalus dalli* (% set) | 1.20 | 1.25 | 5 | 0.00 | 0.00 | 5 | 0.30 | 0.27 | 5 | 0.00 | 0.00 | 5 |
| *Chthamalus dalli* (%) | 6.20 | 3.83 | 5 | 0.10 | 0.22 | 5 | 1.90 | 1.82 | 5 | 0.10 | 0.22 | 5 |
| Gastropoda, eggs | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Littorina* spp., eggs (%) | 0.00 | 0.00 | 5 | 0.30 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Mytilus* cf. *trossulus* (%) | 0.00 | 0.00 | 5 | 0.30 | 0.45 | 5 | 0.30 | 0.27 | 5 | 0.00 | 0.00 | 5 |
| *Mytilus* cf. *trossulus* (% spat) | 0.70 | 0.76 | 5 | 0.00 | 0.00 | 5 | 0.40 | 0.42 | 5 | 1.10 | 2.19 | 5 |
| *Semibalanus balanoides* (% set) | 12.20 | 6.72 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Semibalanus balanoides* (%) | 28.40 | 17.17 | 5 | 1.60 | 1.29 | 5 | 1.40 | 2.01 | 5 | 0.20 | 0.27 | 5 |

## Table B-1-2 (continued)

| | Bass Harbor | | | Block Island | | | Elrington Islet E. | | | Elrington Islet N. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Taxon | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count |
| Black crust (maybe *Hildenbrandia rubra* ) | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 1.70 | 2.22 | 5 |
| *Bildingia minima* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 1.60 | 3.03 | 5 | 4.80 | 6.01 | 5 |
| Blue-green algae, spheroids | 0.00 | 0.00 | 5 | 0.10 | 0.22 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| Bryophyta, unid. | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Cladophora sericea* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.10 | 0.22 | 5 |
| *Endocladia muricata* | 0.10 | 0.22 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| Endozoic green algae | 1.00 | 0.61 | 5 | 0.40 | 0.22 | 5 | 0.20 | 0.27 | 5 | 0.10 | 0.22 | 5 |
| *Fucus gardneri* | 0.80 | 1.30 | 5 | 20.30 | 25.50 | 5 | 0.00 | 0.00 | 5 | 5.10 | 6.99 | 5 |
| *Fucus gardneri* (germlings) | 0.40 | 0.42 | 5 | 0.40 | 0.22 | 5 | 0.30 | 0.27 | 5 | 0.30 | 0.27 | 5 |
| *Gloiopeltis furcata* | 3.30 | 2.22 | 5 | 0.10 | 0.22 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.27 | 5 |
| *Halosaccion glandiforme* | 0.10 | 0.22 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Hildenbrandia rubra* | 1.40 | 2.01 | 5 | 3.70 | 4.06 | 5 | 0.50 | 0.00 | 5 | 9.10 | 10.74 | 5 |
| *Mastocarpus papillatus* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Mazzaella spp.* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Melanosiphon intestinalis* | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Neorhodomela oregona* | 0.40 | 0.89 | 5 | 0.10 | 0.22 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Porphyra* spp. | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Ralfsia fungiformis* | 0.00 | 0.00 | 5 | 0.10 | 0.22 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Ralfsia* spp. | 0.00 | 0.00 | 5 | 2.80 | 5.22 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Soranthera ulvoidea* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.10 | 0.22 | 5 |
| *Ulva/Ulvaria* spp. | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Verrucaria* spp. | 0.00 | 0.00 | 5 | 20.30 | 29.54 | 5 | 0.20 | 0.45 | 5 | 19.00 | 21.33 | 5 |
| | | | | | | | | | | | | |
| *Balanus glandula* (% set) | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 11.00 | 6.08 | 5 |
| *Balanus glandula* (%) | 1.20 | 0.76 | 5 | 0.40 | 0.42 | 5 | 1.20 | 0.76 | 5 | 11.00 | 6.08 | 5 |
| *Balanus/Semibalanus* spp., set (%) | 0.10 | 0.22 | 5 | 0.10 | 0.22 | 5 | 0.50 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Chthamalus dalli* (% set) | 1.20 | 1.25 | 5 | 0.00 | 0.00 | 5 | 0.30 | 0.27 | 5 | 0.00 | 0.00 | 5 |
| *Chthamalus dalli* (%) | 6.20 | 3.83 | 5 | 0.10 | 0.22 | 5 | 1.90 | 1.62 | 5 | 0.10 | 0.22 | 5 |
| Gastropoda, eggs | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Littorina* spp., eggs (%) | 0.00 | 0.00 | 5 | 0.30 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Mytilus* cf. *trossulus* (%) | 0.00 | 0.00 | 5 | 0.30 | 0.45 | 5 | 0.30 | 0.27 | 5 | 0.00 | 0.00 | 5 |
| *Mytilus* cf. *trossulus* (% spat) | 0.70 | 0.76 | 5 | 0.00 | 0.00 | 5 | 0.40 | 0.42 | 5 | 1.10 | 2.19 | 5 |
| *Semibalanus balanoides* (% set) | 12.20 | 6.72 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Semibalanus balanoides* (%) | 28.40 | 17.17 | 5 | 1.60 | 1.29 | 5 | 1.40 | 2.01 | 5 | 0.20 | 0.27 | 5 |

## Table B-1-2 (continued)

| Taxon | Bass Harbor Mean | SD | Count | Block Island Mean | SD | Count | Elrington Islet E. Mean | SD | Count | Elrington Islet N. Mean | SD | Count |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Semibalanus cariosus* (% set) | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Semibalanus cariosus* (%) | 0.80 | 1.79 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| Acarina | P | P | 0 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Emplectonema gracile* | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| Gammaridea, unid. | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Ligia* sp. | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Littorina scutulata* | 184.40 | 154.15 | 5 | 39.40 | 30.25 | 5 | 20.00 | 10.02 | 5 | 4.80 | 7.16 | 5 |
| *Littorina sitkana* | 14.40 | 14.98 | 5 | 86.20 | 99.13 | 5 | 2.00 | 3.39 | 5 | 1.00 | 1.73 | 5 |
| *Lottia pelta* | 2.40 | 1.82 | 5 | 1.20 | 1.79 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 |
| *Lottia strigatella* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 |
| Lottiidae, unid. | 0.00 | 0.00 | 5 | 12.20 | 15.40 | 5 | 2.20 | 1.64 | 5 | 3.60 | 3.58 | 5 |
| Lottiidae, unid. (juv.) | 32.60 | 22.61 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Nucella lamellosa* | 9.20 | 9.31 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Onchidella borealis* | 0.40 | 0.89 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Pagurus hirsutiusculus* | 0.00 | 0.00 | 5 | 2.80 | 6.26 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Siphonaria thersites* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.40 | 0.89 | 5 |
| *Tectura persona* | 0.40 | 0.89 | 5 | 0.00 | 0.00 | 5 | 3.20 | 5.07 | 5 | 0.00 | 0.00 | 5 |
| *Tectura scutum* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Fucus gardneri* (dead) | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Balanus glandula* (% dead) | 0.40 | 0.22 | 5 | 0.20 | 0.27 | 5 | 0.20 | 0.27 | 5 | 0.70 | 0.27 | 5 |
| *Balanus/Semibalanus* spp. (% dead) | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Chthamalus dalli* (% dead) | 0.30 | 0.27 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.27 | 5 | 0.00 | 0.00 | 5 |
| *Mytilus* cf. *trossulus* (dead) | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 |
| *Mytilus* sp. (% set, dead) | 0.60 | 1.34 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Semibalanus balanoides* (% dead) | 1.90 | 1.95 | 5 | 0.10 | 0.22 | 5 | 0.10 | 0.22 | 5 | 0.00 | 0.00 | 5 |
| *Semibalanus balanoides* (% set, dead) | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |

## Table B-1-2 (continued)

| Taxon | Bass Harbor | | | Block Island | | | Elrington Islet E. | | | Elrington Islet N. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count |
| Boulder/cobble (%) | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| Gravel/sand(%) | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| Oil cover (%) (primary) | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.10 | 0.22 | 5 | 0.00 | 0.00 | 5 |
| Oil scale (primary) | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| Oil Scale (secondary) | 0.00 | 0.00 | 5 | 0.10 | 0.22 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| Rock (%) | 100.00 | 0.00 | 5 | 100.00 | 0.00 | 5 | 100.00 | 0.00 | 5 | 100.00 | 0.00 | 5 |
| Water (%) | 0.00 | 0.00 | 5 | 3.00 | 6.71 | 5 | 1.20 | 2.68 | 5 | 0.00 | 0.00 | 5 |

Table B-1-2 (continued)

| Taxon | Elrington Islet W. Mean | SD | Count | Eshamy Bay Mean | SD | Count | Herring Bay Mean | SD | Count | Hogg Bay Mean | SD | Count |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Black crust (maybe *Hildenbrandia rubra* ) | 1.50 | 2.12 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Blidingia minima* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.10 | 0.22 | 5 |
| Blue-green algae, spheroids | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| Bryophyta, unid. | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Cladophora sericea* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Endocladia muricata* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| Endozoic green algae | 0.40 | 0.22 | 5 | 0.30 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Fucus gardneri* | 5.20 | 8.52 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Fucus gardneri* (germlings) | 0.50 | 0.50 | 5 | 0.20 | 0.27 | 5 | 0.20 | 0.27 | 5 | 0.40 | 0.22 | 5 |
| *Gloiopeltis furcata* | 0.30 | 0.27 | 5 | 0.10 | 0.22 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Halosaccion glandiforme* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Hildenbrandia rubra* | 18.40 | 13.87 | 5 | 0.20 | 0.27 | 5 | 0.40 | 0.22 | 5 | 0.80 | 1.30 | 5 |
| *Mastocarpus papillatus* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Mazzaella spp.* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Melanosiphon intestinalis* | 0.10 | 0.22 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Neorhodomela oregona* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Porphyra* spp. | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Ralfsia fungiformis* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Ralfsia* spp. | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Soranthera ulvoidea* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Ulva/Ulvaria* spp. | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Verrucaria* spp. | 0.50 | 0.87 | 5 | 11.10 | 10.11 | 5 | 0.60 | 0.82 | 5 | 92.00 | 6.71 | 5 |
| | | | | | | | | | | | | |
| *Balanus glandula* (% set) | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.27 | 5 |
| *Balanus glandula* (%) | 0.80 | 0.76 | 5 | 0.40 | 0.42 | 5 | 0.30 | 0.27 | 5 | 0.70 | 0.76 | 5 |
| *Balanus/Semibalanus* spp., set (%) | 0.40 | 0.22 | 5 | 0.10 | 0.22 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Chthamalus dalli* (% set) | 0.30 | 0.27 | 5 | 0.10 | 0.22 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Chthamalus dalli* (%) | 0.40 | 0.22 | 5 | 0.30 | 0.27 | 5 | 0.20 | 0.27 | 5 | 0.10 | 0.22 | 5 |
| Gastropoda, eggs | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Littorina* spp., eggs (%) | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Mytilus* cf. *trossulus* (%) | 0.70 | 0.45 | 5 | 0.30 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Mytilus* cf. *trossulus* (% spat) | 0.40 | 0.22 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Semibalanus balanoides* (% set) | 0.10 | 0.22 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Semibalanus balanoides* (%) | 2.00 | 1.84 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |

## Table B-1-2 (continued)

| Taxon | Elrington Islet W. Mean | SD | Count | Eshamy Bay Mean | SD | Count | Herring Bay Mean | SD | Count | Hogg Bay Mean | SD | Count |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Semibalanus cariosus* (% set) | 0.10 | 0.22 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Semibalanus cariosus* (%) | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| Acarina | 0.00 | 0.00 | 5 | P | P | 4 | 0.00 | 0.00 | 5 | P | P | 2 |
| *Emplectonema gracile* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| Gammaridea, unid. | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Ligia* sp. | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.60 | 0.55 | 5 |
| *Littorina scutulata* | 1.40 | 1.67 | 5 | 41.20 | 25.21 | 5 | 43.80 | 16.68 | 5 | 3.20 | 3.70 | 5 |
| *Littorina sitkana* | 8.20 | 16.71 | 5 | 86.00 | 40.91 | 5 | 12.40 | 7.23 | 5 | 22.80 | 17.34 | 5 |
| *Lottia pelta* | 0.80 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Lottia strigatella* | 0.60 | 1.34 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| Lottiidae, unid. | 3.40 | 2.79 | 5 | 0.00 | 0.00 | 5 | 1.20 | 2.17 | 5 | 0.00 | 0.00 | 5 |
| Lottiidae, unid. (juv.) | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Nucella lamellosa* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Onchidella borealis* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Pagurus hirsutiusculus* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Siphonaria thersites* | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Tectura persona* | 1.00 | 0.71 | 5 | 0.60 | 1.34 | 5 | 11.20 | 6.57 | 5 | 0.40 | 0.89 | 5 |
| *Tectura scutum* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Fucus gardneri* (dead) | 0.00 | 0.00 | 5 | 0.10 | 0.22 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Balanus glandula* (% dead) | 0.40 | 0.22 | 5 | 0.30 | 0.27 | 5 | 0.20 | 0.27 | 5 | 0.30 | 0.27 | 5 |
| *Balanus/Semibalanus* spp. (% dead) | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Chthamalus dalli* (% dead) | 0.00 | 0.00 | 5 | 0.30 | 0.27 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Mytilus* cf. *trossulus* (dead) | 0.40 | 0.89 | 5 | 0.40 | 0.89 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Mytilus* sp. (% set, dead) | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Semibalanus balanoides* (% dead) | 0.10 | 0.22 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Semibalanus balanoides* (% set, dead) | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |

Table B-1-2 (continued)

| Taxon | Elrington Islet W. | | | Eshamy Bay | | | Herring Bay | | | Hogg Bay | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count |
| Boulder/cobble (%) | 0.00 | 0.00 | 5 | 99.60 | 0.89 | 5 | 4.00 | 6.52 | 5 | 0.00 | 0.00 | 5 |
| Gravel/sand(%) | 0.00 | 0.00 | 5 | 0.40 | 0.89 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| Oil cover (%) (primary) | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.50 | 0.87 | 5 | 0.00 | 0.00 | 5 |
| Oil scale (primary) | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 2.40 | 3.29 | 5 | 0.00 | 0.00 | 5 |
| Oil Scale (secondary) | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| Rock (%) | 100.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 96.00 | 6.52 | 5 | 100.00 | 0.00 | 5 |
| Water (%) | 1.30 | 1.72 | 5 | 0.20 | 0.27 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 |

**Table B-1-2 (continued)**

| Taxon | Mussel Beach N. | | | Mussel Beach S. | | | NW Bay Islet | | | Outside Bay | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count |
| Black crust (maybe *Hildenbrandia rubra* ) | 0.35 | 0.34 | 10 | 0.10 | 0.22 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Blidingia minima* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.40 | 0.22 | 5 |
| Blue-green algae, spheroids | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| Bryophyta, unid. | 0.00 | 0.00 | 10 | 0.10 | 0.22 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Cladophora sericea* | 1.55 | 4.73 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Endocladia muricata* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.10 | 0.22 | 5 |
| Endozoic green algae | 0.25 | 0.26 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.80 | 1.79 | 5 |
| *Fucus gardneri* | 24.05 | 29.16 | 10 | 0.20 | 0.45 | 5 | 0.10 | 0.22 | 5 | 1.00 | 0.61 | 5 |
| *Fucus gardneri* (germlings) | 1.20 | 0.98 | 10 | 0.10 | 0.22 | 5 | 0.10 | 0.22 | 5 | 1.20 | 1.57 | 5 |
| *Gloiopeltis furcata* | 0.55 | 0.96 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 6.20 | 13.31 | 5 |
| *Halosaccion glandiforme* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Hildenbrandia rubra* | 2.20 | 1.92 | 10 | 0.20 | 0.27 | 5 | 0.40 | 0.42 | 5 | 0.10 | 0.22 | 5 |
| *Mastocarpus papillatus* | 0.10 | 0.32 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Mazzaella spp.* | 0.15 | 0.34 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Melanosiphon intestinalis* | 0.85 | 1.73 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Neorhodomela oregona* | 0.80 | 1.75 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Porphyra* spp. | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.10 | 0.22 | 5 |
| *Ralfsia fungiformis* | 0.10 | 0.32 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Ralfsia* spp. | 2.00 | 6.32 | 10 | 0.00 | 0.00 | 5 | 1.00 | 2.24 | 5 | 0.00 | 0.00 | 5 |
| *Soranthera ulvoidea* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Ulva/Ulvaria* spp. | 2.00 | 6.32 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Verrucaria* spp. | 5.30 | 14.04 | 10 | 3.80 | 3.96 | 5 | 0.20 | 0.45 | 5 | 18.60 | 9.02 | 5 |
| | | | | | | | | | | | | |
| *Balanus glandula* (% set) | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Balanus glandula* (%) | 1.85 | 1.99 | 10 | 0.50 | 0.87 | 5 | 0.30 | 0.45 | 5 | 0.60 | 0.22 | 5 |
| *Balanus/Semibalanus* spp., set (%) | 0.20 | 0.26 | 10 | 0.00 | 0.00 | 5 | 0.10 | 0.22 | 5 | 0.50 | 0.87 | 5 |
| *Chthamalus dalli* (% set) | 0.05 | 0.16 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.30 | 0.27 | 5 |
| *Chthamalus dalli* (%) | 0.85 | 0.47 | 10 | 0.60 | 0.82 | 5 | 0.30 | 0.45 | 5 | 2.10 | 1.43 | 5 |
| Gastropoda, eggs | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Littorina* spp., eggs (%) | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Mytilus* cf. *trossulus* (%) | 3.00 | 5.18 | 10 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 |
| *Mytilus* cf. *trossulus* (% spat) | 0.10 | 0.21 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.10 | 0.22 | 5 |
| *Semibalanus balanoides* (% set) | 0.05 | 0.16 | 10 | 0.00 | 0.00 | 5 | 0.10 | 0.22 | 5 | 0.00 | 0.00 | 5 |
| *Semibalanus balanoides* (%) | 0.35 | 0.63 | 10 | 0.00 | 0.00 | 5 | 0.10 | 0.22 | 5 | 1.30 | 2.64 | 5 |

Table B-1-2 (continued)

| Taxon | Mussel Beach N. Mean | Mussel Beach N. SD | Mussel Beach N. Count | Mussel Beach S. Mean | Mussel Beach S. SD | Mussel Beach S. Count | NW Bay Islet Mean | NW Bay Islet SD | NW Bay Islet Count | Outside Bay Mean | Outside Bay SD | Outside Bay Count |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Semibalanus cariosus* (% set) | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Semibalanus cariosus* (%) | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| Acarina | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | P | P | 3 |
| *Emplectonema gracile* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| Gammaridea, unid. | P | P | 9 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Ligia* sp. | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 |
| *Littorina scutulata* | 44.10 | 36.77 | 10 | 2.00 | 3.08 | 5 | 109.40 | 17.78 | 5 | 144.60 | 130.10 | 5 |
| *Littorina sitkana* | 118.30 | 98.85 | 10 | 43.00 | 21.41 | 5 | 31.20 | 19.29 | 5 | 42.40 | 88.12 | 5 |
| *Lottia pelta* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Lottia strigatella* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| Lottiidae, unid. | 5.50 | 7.11 | 10 | 0.80 | 1.30 | 5 | 2.00 | 3.39 | 5 | 0.00 | 0.00 | 5 |
| Lottiidae, unid. (juv.) | 0.00 | 0.00 | 10 | 2.40 | 5.37 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Nucella lamellosa* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 |
| *Onchidella borealis* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Pagurus hirsutiusculus* | 0.90 | 2.23 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Siphonaria thersites* | 0.10 | 0.32 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Tectura persona* | 0.90 | 1.66 | 10 | 0.00 | 0.00 | 5 | 1.80 | 3.49 | 5 | 0.00 | 0.00 | 5 |
| *Tectura scutum* | 0.20 | 0.63 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Fucus gardneri* (dead) | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Balanus glandula* (% dead) | 0.35 | 0.34 | 10 | 0.00 | 0.00 | 5 | 0.40 | 0.89 | 5 | 0.00 | 0.00 | 5 |
| *Balanus/Semibalanus* spp. (% dead) | 0.05 | 0.16 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Chthamalus dalli* (% dead) | 0.30 | 0.26 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.27 | 5 |
| *Mytilus* cf. *trossulus* (dead) | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Mytilus* sp. (% set, dead) | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Semibalanus balanoides* (% dead) | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| *Semibalanus balanoides* (% set, dead) | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |

**Table B-1-2 (continued)**

| | Mussel Beach N. | | | Mussel Beach S. | | | NW Bay Islet | | | Outside Bay | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Taxon | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count |
| Boulder/cobble (%) | 0.00 | 0.00 | 10 | 58.40 | 53.34 | 5 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 |
| Gravel/sand(%) | 0.00 | 0.00 | 10 | 1.60 | 2.30 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| Oil cover (%) (primary) | 0.00 | 0.00 | 10 | 0.10 | 0.22 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| Oil scale (primary) | 0.00 | 0.00 | 10 | 0.80 | 1.79 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| Oil Scale (secondary) | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |
| Rock (%) | 100.00 | 0.00 | 10 | 40.00 | 54.77 | 5 | 99.80 | 0.45 | 5 | 100.00 | 0.00 | 5 |
| Water (%) | 7.80 | 12.73 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 |

## Table B-1-2 (continued)

| Taxon | Snug Harbor Mean | SD | Count |
|---|---|---|---|
| *Semibalanus cariosus* (% set) | 0.00 | 0.00 | 5 |
| *Semibalanus cariosus* (%) | 0.00 | 0.00 | 5 |
| | | | |
| Acarina | 0.00 | 0.00 | 5 |
| *Emplectonema gracile* | 0.00 | 0.00 | 5 |
| Gammaridea, unid. | P | P | 4 |
| *Ligia* sp. | 0.00 | 0.00 | 5 |
| *Littorina scutulata* | 54.80 | 78.92 | 5 |
| *Littorina sitkana* | 151.80 | 178.43 | 5 |
| *Lottia pelta* | 0.20 | 0.45 | 5 |
| *Lottia strigatella* | 0.00 | 0.00 | 5 |
| Lottiidae, unid. | 2.00 | 2.83 | 5 |
| Lottiidae, unid. (juv.) | 0.80 | 1.79 | 5 |
| *Nucella lamellosa* | 0.00 | 0.00 | 5 |
| *Onchidella borealis* | 0.00 | 0.00 | 5 |
| *Pagurus hirsutiusculus* | 0.40 | 0.89 | 5 |
| *Siphonaria thersites* | 0.00 | 0.00 | 5 |
| *Tectura persona* | 25.80 | 6.42 | 5 |
| *Tectura scutum* | 0.00 | 0.00 | 5 |
| | | | |
| *Fucus gardneri* (dead) | 0.10 | 0.22 | 5 |
| | | | |
| *Balanus glandula* (% dead) | 0.40 | 0.22 | 5 |
| *Balanus/Semibalanus* spp. (% dead) | 0.00 | 0.00 | 5 |
| *Chthamalus dalli* (% dead) | 0.10 | 0.22 | 5 |
| *Mytilus* cf. *trossulus* (dead) | 0.40 | 0.89 | 5 |
| *Mytilus* sp. (% set, dead) | 0.00 | 0.00 | 5 |
| *Semibalanus balanoides* (% dead) | 0.10 | 0.22 | 5 |
| *Semibalanus balanoides* (% set, dead) | 0.10 | 0.22 | 5 |

**Table B-1-2 (continued)**

| | Snug Harbor | | |
|---|---|---|---|
| Taxon | Mean | SD | Count |
| Boulder/cobble (%) | 97.40 | 2.30 | 5 |
| Gravel/sand(%) | 2.60 | 2.30 | 5 |
| Oil cover (%) (primary) | 0.00 | 0.00 | 5 |
| Oil scale (primary) | 0.00 | 0.00 | 5 |
| Oil Scale (secondary) | 0.00 | 0.00 | 5 |
| Rock (%) | 0.00 | 0.00 | 5 |
| Water (%) | 0.00 | 0.00 | 5 |

**Table B-1-3 QC results from rocky middle intertidal epibiota, June 1994.**

| | Block Island | | | Crab Bay | | | Elrington East | | | Elrington West | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Taxon | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count |
| *Acrosiphonia arcta* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.13 | 0.25 | 4 | 0.00 | 0.00 | 5 |
| Black crust (maybe Hildenbrandia rubra) | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 3.00 | 2.00 | 4 | 0.40 | 0.55 | 5 |
| *Blidingia minima* | 0.00 | 0.00 | 10 | 0.05 | 0.16 | 10 | 0.50 | 0.00 | 4 | 0.40 | 0.55 | 5 |
| Blue-green algae, crust | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| Blue-green algae, spheroids | 0.10 | 0.21 | 10 | 0.05 | 0.16 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| *Callithamnion pikeanum* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| *Caulacanthus ustulatus* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| *Chaetomorpha tortuosa* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| *Cladophora sericea* | 0.10 | 0.21 | 10 | 0.00 | 0.00 | 10 | 1.88 | 2.25 | 4 | 1.30 | 2.64 | 5 |
| *Cryptosiphonia woodii* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.10 | 0.22 | 5 |
| *Dictyosiphon foeniculaceus* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| *Elachista fucicola* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| Encrusting coralline algae | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.10 | 0.22 | 5 |
| *Endocladia muricata* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| Endozoic green algae | 0.80 | 0.48 | 10 | 0.35 | 0.24 | 10 | 0.00 | 0.00 | 4 | 0.20 | 0.27 | 5 |
| *Enteromorpha intestinalis* | 0.05 | 0.16 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| Flagelliform brown algae | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| *Fucus gardneri* | 54.50 | 19.07 | 10 | 49.00 | 31.55 | 10 | 48.75 | 19.31 | 4 | 35.60 | 33.16 | 5 |
| *Fucus gardneri (germlings)* | 1.35 | 1.43 | 10 | 0.70 | 0.54 | 10 | 0.25 | 0.50 | 4 | 0.60 | 0.22 | 5 |
| *Gloiopeltis furcata* | 0.50 | 0.24 | 10 | 1.00 | 0.62 | 10 | 0.25 | 0.29 | 4 | 0.60 | 0.55 | 5 |
| *Halosaccion glandiforme* | 0.10 | 0.21 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| *Hildenbrandia rubra* | 0.70 | 0.54 | 10 | 0.05 | 0.16 | 10 | 17.00 | 8.52 | 4 | 6.00 | 6.96 | 5 |
| *Leathesia difformis* | 0.05 | 0.16 | 10 | 0.05 | 0.16 | 10 | 0.00 | 0.00 | 4 | 0.10 | 0.22 | 5 |
| *Mastocarpus papillatus* | 0.15 | 0.24 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| *Mazzaella spp.* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 5.25 | 6.84 | 4 | 0.80 | 1.79 | 5 |
| *Melanosiphon intestinalis* | 0.10 | 0.21 | 10 | 0.00 | 0.00 | 10 | 0.25 | 0.50 | 4 | 0.10 | 0.22 | 5 |
| *Monostroma grevillei* | 0.10 | 0.21 | 10 | 0.00 | 0.00 | 10 | 0.25 | 0.29 | 4 | 0.10 | 0.22 | 5 |
| *Neorhodomela oregona* | 3.15 | 5.16 | 10 | 0.45 | 1.26 | 10 | 0.00 | 0.00 | 4 | 1.60 | 1.52 | 5 |
| *Neorhodomela larix* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| *Odonthalia floccosa* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| *Palmaria callophylloides* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.10 | 0.22 | 5 |
| *Petrocelis spp.* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| *Pilayella littoralis* | 0.25 | 0.63 | 10 | 0.10 | 0.32 | 10 | 17.50 | 15.00 | 4 | 6.00 | 13.42 | 5 |
| *Polysiphonia/Pterosiphonia spp.* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| *Porphyra spp.* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| *Pterosiphonia bipinnata* | 0.10 | 0.32 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 12.00 | 17.89 | 5 |
| *Ralfsia spp.* | 0.20 | 0.63 | 10 | 0.00 | 0.00 | 10 | 6.75 | 12.20 | 4 | 0.60 | 1.34 | 5 |
| *Rhodochorton purpureum* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| *Soranthera ulvoidea* | 0.05 | 0.16 | 10 | 0.05 | 0.16 | 10 | 0.00 | 0.00 | 4 | 0.30 | 0.27 | 5 |

## Table B-1-3 (continued)

| Taxon | Block Island | | | Crab Bay | | | Elrington East | | | Elrington West | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count |
| *Acrosiphonia arcta* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.13 | 0.25 | 4 | 0.00 | 0.00 | 5 |
| Black crust (maybe Hildenbrandia rubra) | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 3.00 | 2.00 | 4 | 0.40 | 0.55 | 5 |
| *Blidingia minima* | 0.00 | 0.00 | 10 | 0.05 | 0.16 | 10 | 0.50 | 0.00 | 4 | 0.40 | 0.55 | 5 |
| Blue-green algae, crust | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| Blue-green algae, spheroids | 0.10 | 0.21 | 10 | 0.05 | 0.16 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| *Callithamnion pikeanum* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| *Caulacanthus ustulatus* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| *Chaetomorpha tortuosa* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| *Cladophora sericea* | 0.10 | 0.21 | 10 | 0.00 | 0.00 | 10 | 1.88 | 2.25 | 4 | 1.30 | 2.64 | 5 |
| *Cryptosiphonia woodii* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.10 | 0.22 | 5 |
| *Dictyosiphon foeniculaceus* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| *Elachista fucicola* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| Encrusting coralline algae | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.10 | 0.22 | 5 |
| *Endocladia muricata* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| Endozoic green algae | 0.80 | 0.48 | 10 | 0.35 | 0.24 | 10 | 0.00 | 0.00 | 4 | 0.20 | 0.27 | 5 |
| *Enteromorpha intestinalis* | 0.05 | 0.16 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| Flagelliform brown algae | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| *Fucus gardneri* | 54.50 | 19.07 | 10 | 49.00 | 31.55 | 10 | 48.75 | 19.31 | 4 | 35.60 | 33.16 | 5 |
| *Fucus gardneri (germlings)* | 1.35 | 1.43 | 10 | 0.70 | 0.54 | 10 | 0.25 | 0.50 | 4 | 0.60 | 0.22 | 5 |
| *Gloiopeltis furcata* | 0.50 | 0.24 | 10 | 1.00 | 0.62 | 10 | 0.25 | 0.29 | 4 | 0.60 | 0.55 | 5 |
| *Halosaccion glandiforme* | 0.10 | 0.21 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| *Hildenbrandia rubra* | 0.70 | 0.54 | 10 | 0.05 | 0.16 | 10 | 17.00 | 8.52 | 4 | 6.00 | 6.96 | 5 |
| *Leathesia difformis* | 0.05 | 0.16 | 10 | 0.05 | 0.16 | 10 | 0.00 | 0.00 | 4 | 0.10 | 0.22 | 5 |
| *Mastocarpus papillatus* | 0.15 | 0.24 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| *Mazzaella spp.* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 5.25 | 6.84 | 4 | 0.80 | 1.79 | 5 |
| *Melanosiphon intestinalis* | 0.10 | 0.21 | 10 | 0.00 | 0.00 | 10 | 0.25 | 0.50 | 4 | 0.10 | 0.22 | 5 |
| *Monostroma grevillei* | 0.10 | 0.21 | 10 | 0.00 | 0.00 | 10 | 0.25 | 0.29 | 4 | 0.10 | 0.22 | 5 |
| *Neorhodomela oregona* | 3.15 | 5.16 | 10 | 0.45 | 1.26 | 10 | 0.00 | 0.00 | 4 | 1.60 | 1.52 | 5 |
| *Neorhodomela larix* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| *Odonthalia floccosa* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| *Palmaria callophylloides* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.10 | 0.22 | 5 |
| *Petrocelis spp.* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| *Pilayella littoralis* | 0.25 | 0.63 | 10 | 0.10 | 0.32 | 10 | 17.50 | 15.00 | 4 | 6.00 | 13.42 | 5 |
| *Polysiphonia/Pterosiphonia spp.* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| *Porphyra spp.* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| *Pterosiphonia bipinnata* | 0.10 | 0.32 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 12.00 | 17.89 | 5 |
| *Ralfsia spp.* | 0.20 | 0.63 | 10 | 0.00 | 0.00 | 10 | 6.75 | 12.20 | 4 | 0.60 | 1.34 | 5 |
| *Rhodochorton purpureum* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| *Soranthera ulvoidea* | 0.05 | 0.16 | 10 | 0.05 | 0.16 | 10 | 0.00 | 0.00 | 4 | 0.30 | 0.27 | 5 |

**Table B-1-3 (continued)**

| Taxon | Block Island | | | Crab Bay | | | Elrington East | | | Elrington West | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count |
| *Littorina scutulata (juv.)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| *Littorina sitkana* | 30.90 | 34.40 | 10 | 121.50 | 156.29 | 10 | 0.00 | 0.00 | 4 | 9.80 | 21.36 | 5 |
| *Lottia pelta* | 6.60 | 9.73 | 10 | 2.40 | 1.84 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| Lottiidae, unid. | 41.10 | 23.72 | 10 | 0.00 | 0.00 | 10 | 0.50 | 1.00 | 4 | 1.20 | 2.17 | 5 |
| Lottiidae, unid. (juv.) | 0.00 | 0.00 | 10 | 30.60 | 27.93 | 10 | 0.75 | 0.96 | 4 | 17.40 | 32.35 | 5 |
| Nemertea, unid. | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| *Notoplana sp.* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| *Nucella lamellosa* | 0.00 | 0.00 | 10 | 8.30 | 13.87 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| *Nucella lima* | 0.10 | 0.32 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| *Onchidella borealis* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.75 | 0.96 | 4 | 2.40 | 5.37 | 5 |
| *Pagurus granosimanus* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 7.40 | 7.23 | 5 |
| *Pagurus hirsutiusculus* | 42.60 | 39.33 | 10 | 5.40 | 7.78 | 10 | 25.50 | 28.34 | 4 | 0.20 | 0.45 | 5 |
| *Pagurus spp.* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 5.40 | 9.53 | 5 |
| Pholidae/Stichaeidae | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| *Pododesmus macroschismata* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| Polychaeta, unid. | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| *Searlesia dira* | 1.70 | 4.42 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.20 | 0.45 | 5 |
| *Siphonaria thersites* | 0.70 | 1.57 | 10 | 1.80 | 1.40 | 10 | 0.00 | 0.00 | 4 | 0.60 | 0.89 | 5 |
| *Strongylocentrotus droebachiensis* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| *Tectura persona* | 0.00 | 0.00 | 10 | 3.70 | 4.00 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| *Tectura scutum* | 0.60 | 1.26 | 10 | 0.00 | 0.00 | 10 | 0.50 | 0.58 | 4 | 0.40 | 0.55 | 5 |
| *Tonicella lineata* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| *Volutharpa ampullacea* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.50 | 0.58 | 4 | 0.20 | 0.45 | 5 |
| | | | | | | | | | | | | |
| Encrusting coralline algae (dead) | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| *Fucus gardneri (dead)* | 0.20 | 0.35 | 10 | 0.15 | 0.24 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| | | | | | | | | | | | | |
| *Balanus crenatus (% dead)* | 0.00 | 0.00 | 10 | 0.05 | 0.16 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| *Balanus glandula (% dead)* | 1.50 | 3.04 | 10 | 0.20 | 0.35 | 10 | 0.00 | 0.00 | 4 | 0.20 | 0.27 | 5 |
| *Balanus/Semibalanus spp. (% dead)* | 0.00 | 0.00 | 10 | 0.05 | 0.16 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| *Balanus/Semibalanus spp. (% set, dead)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| *Chthamalus dalli (% dead)* | 0.05 | 0.16 | 10 | 0.10 | 0.21 | 10 | 0.00 | 0.00 | 4 | 0.20 | 0.27 | 5 |
| *Chthamalus dalli (% set, dead)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| *Mytilus cf. trossulus (dead)* | 4.40 | 2.37 | 10 | 12.40 | 14.33 | 10 | 0.00 | 0.00 | 4 | 0.20 | 0.45 | 5 |
| *Mytilus sp. (% set, dead)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| *Semibalanus balanoides (% dead)* | 1.10 | 1.17 | 10 | 0.25 | 0.26 | 10 | 0.00 | 0.00 | 4 | 0.20 | 0.27 | 5 |
| *Semibalanus balanoides (% set, dead)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| *Semibalanus cariosus (% set, dead)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |

**Table B-1-3 (continued)**

| Taxon | Block Island | | | Crab Bay | | | Elrington East | | | Elrington West | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count |
| Boulder/cobble (%) | 0.00 | 0.00 | 10 | 38.90 | 40.26 | 10 | 99.50 | 1.00 | 4 | 21.00 | 44.22 | 5 |
| Gravel/sand(%) | 0.00 | 0.00 | 10 | 10.30 | 14.78 | 10 | 0.50 | 1.00 | 4 | 0.00 | 0.00 | 5 |
| Mud (%) | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |
| Rock (%) | 100.00 | 0.00 | 10 | 51.30 | 47.27 | 10 | 0.00 | 0.00 | 4 | 79.00 | 44.22 | 5 |
| Water (%) | 3.70 | 6.13 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 4 | 0.00 | 0.00 | 5 |

**Table B-1-3 (continued)**

| Taxon | Eshamy Bay | | | Herring Bay | | | Hogg Bay | | | Mussel Beach N | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count |
| *Acrosiphonia arcta* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.10 | 0.32 | 10 | 0.00 | 0.00 | 10 |
| Black crust (maybe Hildenbrandia rubra) | 0.00 | 0.00 | 10 | 0.05 | 0.16 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Bildingia minima* | 0.25 | 0.63 | 10 | 0.00 | 0.00 | 10 | 1.75 | 1.83 | 10 | 0.00 | 0.00 | 10 |
| Blue-green algae, crust | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.10 | 0.21 | 10 |
| Blue-green algae, spheroids | 0.05 | 0.16 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.25 | 0.26 | 10 |
| *Callithamnion pikeanum* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.05 | 0.16 | 10 | 0.00 | 0.00 | 10 |
| *Caulacanthus ustulatus* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.50 | 0.82 | 10 | 0.00 | 0.00 | 10 |
| *Chaetomorpha tortuosa* | 2.60 | 4.67 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Cladophora sericea* | 1.90 | 2.11 | 10 | 1.55 | 4.73 | 10 | 0.55 | 0.93 | 10 | 0.35 | 0.63 | 10 |
| *Cryptosiphonia woodii* | 0.50 | 1.58 | 10 | 0.05 | 0.16 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Dictyosiphon foeniculaceus* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.70 | 1.64 | 10 |
| *Elachista fucicola* | 0.00 | 0.00 | 10 | 0.10 | 0.32 | 10 | 7.30 | 5.38 | 10 | 0.20 | 0.42 | 10 |
| Encrusting coralline algae | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 2.70 | 6.27 | 10 |
| *Endocladia muricata* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.10 | 0.32 | 10 | 0.00 | 0.00 | 10 |
| Endozoic green algae | 0.10 | 0.21 | 10 | 0.35 | 0.34 | 10 | 0.80 | 1.53 | 10 | 0.25 | 0.26 | 10 |
| *Enteromorpha intestinalis* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| Flagelliform brown algae | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Fucus gardneri* | 25.30 | 27.68 | 10 | 65.70 | 21.41 | 10 | 74.60 | 26.42 | 10 | 36.35 | 24.55 | 10 |
| *Fucus gardneri (germlings)* | 1.25 | 0.82 | 10 | 0.15 | 0.24 | 10 | 1.45 | 1.28 | 10 | 1.60 | 2.34 | 10 |
| *Gloiopeltis furcata* | 1.05 | 1.54 | 10 | 0.10 | 0.21 | 10 | 0.40 | 0.32 | 10 | 0.90 | 0.66 | 10 |
| *Halosaccion glandiforme* | 0.05 | 0.16 | 10 | 0.00 | 0.00 | 10 | 0.50 | 0.94 | 10 | 0.00 | 0.00 | 10 |
| *Hildenbrandia rubra* | 0.15 | 0.34 | 10 | 0.05 | 0.16 | 10 | 8.10 | 8.85 | 10 | 0.30 | 0.63 | 10 |
| *Leathesia difformis* | 0.00 | 0.00 | 10 | 0.10 | 0.32 | 10 | 0.05 | 0.16 | 10 | 0.05 | 0.16 | 10 |
| *Mastocarpus papillatus* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.70 | 0.79 | 10 | 0.00 | 0.00 | 10 |
| *Mazzaella spp.* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Melanosiphon intestinalis* | 0.15 | 0.24 | 10 | 0.00 | 0.00 | 10 | 0.15 | 0.24 | 10 | 1.10 | 1.17 | 10 |
| *Monostroma grevillei* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.10 | 0.32 | 10 | 0.10 | 0.21 | 10 |
| *Neorhodomela oregona* | 2.75 | 7.83 | 10 | 1.50 | 3.71 | 10 | 0.60 | 1.56 | 10 | 2.80 | 3.73 | 10 |
| *Neorhodomela larix* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Odonthalia floccosa* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.80 | 2.53 | 10 |
| *Palmaria callophylloides* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 1.65 | 4.70 | 10 | 0.00 | 0.00 | 10 |
| *Petrocelis spp.* | 0.00 | 0.00 | 10 | 0.05 | 0.16 | 10 | 0.00 | 0.00 | 10 | 0.05 | 0.16 | 10 |
| *Pilayella littoralis* | 1.65 | 3.21 | 10 | 0.10 | 0.32 | 10 | 1.30 | 2.04 | 10 | 0.35 | 0.94 | 10 |
| *Polysiphonia/Pterosiphonia spp.* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 1.35 | 3.76 | 10 |
| *Porphyra spp.* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.20 | 0.26 | 10 | 0.00 | 0.00 | 10 |
| *Pterosiphonia bipinnata* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.05 | 0.16 | 10 | 0.60 | 1.35 | 10 |
| *Ralfsia spp.* | 0.10 | 0.21 | 10 | 0.30 | 0.26 | 10 | 0.00 | 0.00 | 10 | 1.30 | 2.38 | 10 |
| *Rhodochorton purpureum* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Soranthera ulvoidea* | 0.20 | 0.63 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 1.55 | 3.11 | 10 |

**Table B-1-3 (continued)**

| | Eshamy Bay | | | Herring Bay | | | Hogg Bay | | | Mussel Beach N | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Taxon | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count |
| *Sphacelaria rigidula* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Ulva/Ulvaria spp.* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.50 | 0.94 | 10 | 0.00 | 0.00 | 10 |
| *Verrucaria spp.* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.10 | 0.32 | 10 | 0.00 | 0.00 | 10 |
| | | | | | | | | | | | | |
| *Balanus glandula (% set)* | 0.05 | 0.16 | 10 | 0.00 | 0.00 | 10 | 0.30 | 0.42 | 10 | 0.15 | 0.34 | 10 |
| *Balanus glandula (%)* | 0.35 | 0.41 | 10 | 0.20 | 0.26 | 10 | 6.95 | 11.10 | 10 | 2.55 | 2.01 | 10 |
| *Balanus rostratus (%)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Balanus/Semibalanus spp. (%)* | 0.05 | 0.16 | 10 | 0.00 | 0.00 | 10 | 0.05 | 0.16 | 10 | 0.00 | 0.00 | 10 |
| *Balanus/Semibalanus spp., set (%)* | 3.75 | 9.41 | 10 | 0.00 | 0.00 | 10 | 29.05 | 24.10 | 10 | 0.05 | 0.16 | 10 |
| *Chthamalus dalli (% set)* | 0.15 | 0.24 | 10 | 0.00 | 0.00 | 10 | 6.05 | 8.72 | 10 | 1.30 | 3.13 | 10 |
| *Chthamalus dalli (%)* | 1.80 | 1.84 | 10 | 0.20 | 0.26 | 10 | 4.55 | 8.50 | 10 | 5.25 | 4.86 | 10 |
| Encrusting bryozoan (%) | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| Encrusting sponge (%) | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.10 | 0.32 | 10 | 0.00 | 0.00 | 10 |
| *Halichondria panicea (%)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| Herring eggs (%) | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Littorina spp., eggs (%)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Mytilus sp. (% spat)* | 0.05 | 0.16 | 10 | 0.70 | 0.26 | 10 | 4.75 | 11.07 | 10 | 2.70 | 6.10 | 10 |
| *Mytilus cf. trossulus (%)* | 10.50 | 22.42 | 10 | 6.05 | 4.74 | 10 | 0.85 | 2.52 | 10 | 11.00 | 15.73 | 10 |
| *Nucella spp. (% eggs)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Semibalanus balanoides (% set)* | 0.05 | 0.16 | 10 | 12.50 | 8.88 | 10 | 0.25 | 0.63 | 10 | 0.30 | 0.63 | 10 |
| *Semibalanus balanoides (%)* | 1.15 | 3.46 | 10 | 19.80 | 15.30 | 10 | 0.45 | 0.96 | 10 | 1.70 | 3.06 | 10 |
| *Semibalanus cariosus (% set)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.10 | 0.21 | 10 | 0.15 | 0.34 | 10 |
| *Semibalanus cariosus (%)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 17.20 | 16.96 | 10 | 0.85 | 0.97 | 10 |
| *Siphonaria thersites, eggs (%)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.85 | 0.85 | 10 | 0.10 | 0.21 | 10 |
| Spirorbidae, unid. (%) | 0.05 | 0.16 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.30 | 0.95 | 10 |
| | | | | | | | | | | | | |
| Acarina | P | P | 9 | P | P | 8 | P | P | 1 | P | P | 9 |
| *Amphiporus spp.* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.30 | 0.67 | 10 | 0.20 | 0.42 | 10 |
| *Anthopleura artemisia* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Anthopleura xanthogrammica* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.10 | 0.32 | 10 |
| *Clinocottus acuticeps* | 0.10 | 0.32 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Emplectonema gracile* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.30 | 0.48 | 10 | 0.00 | 0.00 | 10 |
| *Evasterias troschelii* | 0.00 | 0.00 | 10 | 0.10 | 0.32 | 10 | 0.00 | 0.00 | 10 | 0.10 | 0.32 | 10 |
| Gammaridea, unid. | 0.00 | 0.00 | 10 | P | P | 9 | P | P | 8 | P | P | 8 |
| *Gnorimosphaeroma oregonensis* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Hemigrapsus oregonensis* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.10 | 0.32 | 10 |
| *Insect larvae* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | P | P | 9 |
| *Katharina tunicata* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.20 | 0.42 | 10 |
| *Lacuna spp.* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Leptasterias hexactis* | 0.10 | 0.32 | 10 | 0.00 | 0.00 | 10 | 1.20 | 1.48 | 10 | 2.10 | 3.78 | 10 |
| *Littorina scutulata* | 132.00 | 245.00 | 10 | 117.70 | 85.51 | 10 | 41.00 | 46.15 | 10 | 46.30 | 54.64 | 10 |

## Table B-1-3 (continued)

| Taxon | Eshamy Bay Mean | Eshamy Bay SD | Eshamy Bay Count | Herring Bay Mean | Herring Bay SD | Herring Bay Count | Hogg Bay Mean | Hogg Bay SD | Hogg Bay Count | Mussel Beach N Mean | Mussel Beach N SD | Mussel Beach N Count |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Littorina scutulata (juv.)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Littorina sitkana* | 13.50 | 22.36 | 10 | 127.70 | 122.76 | 10 | 6.50 | 8.29 | 10 | 6.40 | 16.91 | 10 |
| *Lottia pelta* | 0.80 | 1.32 | 10 | 8.30 | 11.03 | 10 | 3.40 | 2.46 | 10 | 1.40 | 1.78 | 10 |
| Lottiidae, unid. | 7.60 | 18.15 | 10 | 13.70 | 19.62 | 10 | 0.00 | 0.00 | 10 | 159.20 | 146.98 | 10 |
| Lottiidae, unid. (juv.) | 14.00 | 18.28 | 10 | 39.20 | 22.04 | 10 | 11.40 | 14.79 | 10 | 0.00 | 0.00 | 10 |
| Nemertea, unid. | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.10 | 0.32 | 10 |
| *Notoplana sp.* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.10 | 0.32 | 10 | 0.00 | 0.00 | 10 |
| *Nucella lamellosa* | 4.00 | 4.71 | 10 | 0.00 | 0.00 | 10 | 19.30 | 19.21 | 10 | 1.00 | 1.70 | 10 |
| *Nucella lima* | 0.00 | 0.00 | 10 | 4.00 | 3.53 | 10 | 0.00 | 0.00 | 10 | 0.10 | 0.32 | 10 |
| *Onchidella borealis* | 0.00 | 0.00 | 10 | 0.10 | 0.32 | 10 | 2.80 | 3.16 | 10 | 0.30 | 0.95 | 10 |
| *Pagurus granosimanus* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Pagurus hirsutiusculus* | 15.30 | 21.86 | 10 | 10.70 | 10.21 | 10 | 11.60 | 26.19 | 10 | 15.30 | 15.66 | 10 |
| *Pagurus spp.* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| Pholidae/Stichaeidae | 0.00 | 0.00 | 10 | 0.10 | 0.32 | 10 | 0.00 | 0.00 | 10 | 0.10 | 0.32 | 10 |
| *Pododesmus macroschismata* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| Polychaeta, unid. | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.20 | 0.63 | 10 |
| *Searlesia dira* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 3.70 | 6.70 | 10 |
| *Siphonaria thersites* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 19.00 | 17.75 | 10 | 4.70 | 8.37 | 10 |
| *Strongylocentrotus droebachiensis* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.60 | 1.58 | 10 |
| *Tectura persona* | 0.10 | 0.32 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Tectura scutum* | 0.20 | 0.42 | 10 | 0.00 | 0.00 | 10 | 0.70 | 1.06 | 10 | 0.10 | 0.32 | 10 |
| *Tonicella lineata* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.50 | 1.58 | 10 |
| *Volutharpa ampullacea* | 0.20 | 0.63 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| | | | | | | | | | | | | |
| Encrusting coralline algae (dead) | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.30 | 0.95 | 10 |
| *Fucus gardneri (dead)* | 0.10 | 0.21 | 10 | 0.20 | 0.35 | 10 | 0.05 | 0.16 | 10 | 0.30 | 0.42 | 10 |
| | | | | | | | | | | | | |
| *Balanus crenatus (% dead)* | 0.00 | 0.00 | 10 | 0.05 | 0.16 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Balanus glandula (% dead)* | 0.55 | 0.60 | 10 | 0.00 | 0.00 | 10 | 0.85 | 1.08 | 10 | 0.70 | 1.53 | 10 |
| *Balanus/Semibalanus spp. (% dead)* | 0.05 | 0.16 | 10 | 0.00 | 0.00 | 10 | 0.05 | 0.16 | 10 | 0.05 | 0.16 | 10 |
| *Balanus/Semibalanus spp. (% set, dead)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.30 | 0.48 | 10 | 0.00 | 0.00 | 10 |
| *Chthamalus dalli (% dead)* | 0.40 | 0.32 | 10 | 0.00 | 0.00 | 10 | 0.95 | 1.26 | 10 | 0.35 | 0.34 | 10 |
| *Chthamalus dalli (% set, dead)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.30 | 0.95 | 10 | 0.00 | 0.00 | 10 |
| *Mytilus cf. trossulus (dead)* | 5.40 | 7.29 | 10 | 3.00 | 3.06 | 10 | 6.40 | 17.91 | 10 | 9.70 | 17.04 | 10 |
| *Mytilus sp. (% set, dead)* | 0.20 | 0.63 | 10 | 0.00 | 0.00 | 10 | 24.30 | 44.47 | 10 | 0.00 | 0.00 | 10 |
| *Semibalanus balanoides (% dead)* | 0.00 | 0.00 | 10 | 0.40 | 0.32 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Semibalanus balanoides (% set, dead)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Semibalanus cariosus (% set, dead)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.20 | 0.26 | 10 | 0.05 | 0.16 | 10 |

## Table B-1-3 (continued)

| Taxon | Eshamy Bay | | | Herring Bay | | | Hogg Bay | | | Mussel Beach N | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count |
| Boulder/cobble (%) | 65.80 | 34.20 | 10 | 6.00 | 18.97 | 10 | 74.00 | 42.80 | 10 | 0.00 | 0.00 | 10 |
| Gravel/sand(%) | 10.50 | 17.98 | 10 | 1.00 | 3.16 | 10 | 0.50 | 1.58 | 10 | 0.00 | 0.00 | 10 |
| Mud (%) | 0.00 | 0.00 | 10 | 1.30 | 4.11 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| Rock (%) | 23.70 | 31.59 | 10 | 89.60 | 22.08 | 10 | 25.50 | 42.32 | 10 | 100.00 | 0.00 | 10 |
| Water (%) | 1.00 | 3.16 | 10 | 0.15 | 0.34 | 10 | 0.20 | 0.63 | 10 | 5.20 | 10.85 | 10 |

## Table B-1-3 (continued)

| Taxon | NW Bay Islet | | | NW Bay W Arm Cat 3 | | | NW Bay W Arm Cat ? | | | Omni Site | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count |
| *Acrosiphonia arcta* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 10 |
| Black crust (maybe Hildenbrandia rubra) | 0.00 | 0.00 | 10 | 0.40 | 0.89 | 5 | 0.40 | 0.22 | 5 | 0.00 | 0.00 | 10 |
| *Blidingia minima* | 0.10 | 0.21 | 10 | 0.20 | 0.45 | 5 | 0.20 | 0.27 | 5 | 0.00 | 0.00 | 10 |
| Blue-green algae, crust | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 10 |
| Blue-green algae, spheroids | 0.25 | 0.35 | 10 | 0.00 | 0.00 | 5 | 0.60 | 1.34 | 5 | 0.00 | 0.00 | 10 |
| *Callithamnion pikeanum* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.60 | 0.82 | 5 | 0.00 | 0.00 | 10 |
| *Caulacanthus ustulatus* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 10 |
| *Chaetomorpha tortuosa* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 10 |
| *Cladophora sericea* | 0.20 | 0.63 | 10 | 1.30 | 0.97 | 5 | 9.30 | 10.51 | 5 | 0.00 | 0.00 | 10 |
| *Cryptosiphonia woodii* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.30 | 0.45 | 5 | 0.00 | 0.00 | 10 |
| *Dictyosiphon foeniculaceus* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 10 |
| *Elachista fucicola* | 0.00 | 0.00 | 10 | 1.00 | 2.24 | 5 | 0.70 | 1.30 | 5 | 0.00 | 0.00 | 10 |
| Encrusting coralline algae | 0.00 | 0.00 | 10 | 0.90 | 1.75 | 5 | 1.20 | 1.64 | 5 | 0.00 | 0.00 | 10 |
| *Endocladia muricata* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 10 |
| Endozoic green algae | 0.50 | 0.62 | 10 | 0.30 | 0.27 | 5 | 0.20 | 0.27 | 5 | 0.00 | 0.00 | 10 |
| *Enteromorpha intestinalis* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 10 |
| Flagelliform brown algae | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 10 |
| *Fucus gardneri* | 30.45 | 38.79 | 10 | 34.00 | 20.43 | 5 | 40.60 | 19.15 | 5 | 41.50 | 21.48 | 10 |
| *Fucus gardneri (germlings)* | 0.25 | 0.26 | 10 | 0.60 | 0.22 | 5 | 3.80 | 6.29 | 5 | 0.00 | 0.00 | 10 |
| *Gloiopeltis furcata* | 0.60 | 1.05 | 10 | 0.30 | 0.45 | 5 | 2.20 | 2.14 | 5 | 0.00 | 0.00 | 10 |
| *Halosaccion glandiforme* | 0.00 | 0.00 | 10 | 0.10 | 0.22 | 5 | 4.20 | 1.30 | 5 | 0.00 | 0.00 | 10 |
| *Hildenbrandia rubra* | 0.05 | 0.16 | 10 | 7.80 | 11.16 | 5 | 14.40 | 16.32 | 5 | 0.00 | 0.00 | 10 |
| *Leathesia difformis* | 0.05 | 0.16 | 10 | 0.40 | 0.42 | 5 | 0.30 | 0.45 | 5 | 0.00 | 0.00 | 10 |
| *Mastocarpus papillatus* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.20 | 0.27 | 5 | 0.00 | 0.00 | 10 |
| *Mazzaella spp.* | 0.00 | 0.00 | 10 | 0.20 | 0.27 | 5 | 1.50 | 2.55 | 5 | 0.00 | 0.00 | 10 |
| *Melanosiphon intestinalis* | 0.10 | 0.21 | 10 | 0.10 | 0.22 | 5 | 0.70 | 0.84 | 5 | 0.00 | 0.00 | 10 |
| *Monostroma grevillei* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.50 | 0.87 | 5 | 0.00 | 0.00 | 10 |
| *Neorhodomela oregona* | 0.30 | 0.95 | 10 | 6.50 | 6.54 | 5 | 4.40 | 2.97 | 5 | 0.00 | 0.00 | 10 |
| *Neorhodomela larix* | 0.00 | 0.00 | 10 | 1.00 | 2.24 | 5 | 2.00 | 3.08 | 5 | 0.00 | 0.00 | 10 |
| *Odonthalia floccosa* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 10 |
| *Palmaria callophylloides* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 10 |
| *Petrocelis spp.* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 10 |
| *Pilayella littoralis* | 0.00 | 0.00 | 10 | 0.40 | 0.89 | 5 | 6.60 | 6.50 | 5 | 0.00 | 0.00 | 10 |
| *Polysiphonia/Pterosiphonia spp.* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 10 |
| *Porphyra spp.* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 10 |
| *Pterosiphonia bipinnata* | 0.20 | 0.63 | 10 | 0.00 | 0.00 | 5 | 3.20 | 2.17 | 5 | 0.00 | 0.00 | 10 |
| *Ralfsia spp.* | 0.10 | 0.21 | 10 | 0.10 | 0.22 | 5 | 3.00 | 4.47 | 5 | 0.00 | 0.00 | 10 |
| *Rhodochorton purpureum* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 10 |
| *Soranthera ulvoidea* | 0.00 | 0.00 | 10 | 0.30 | 0.45 | 5 | 0.20 | 0.27 | 5 | 0.00 | 0.00 | 10 |

## Table B-1-3 (continued)

| | NW Bay Islet | | | NW Bay W Arm Cat 3 | | | NW Bay W Arm Cat ? | | | Omni Site | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Taxon | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count |
| *Sphacelaria rigidula* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 10 |
| *Ulva/Ulvaria spp.* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 10 |
| *Verrucaria spp.* | 0.10 | 0.21 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 10 |
| | | | | | | | | | | | | |
| *Balanus glandula (% set)* | 0.00 | 0.00 | 10 | 0.40 | 0.89 | 5 | 1.00 | 1.41 | 5 | 0.00 | 0.00 | 10 |
| *Balanus glandula (%)* | 4.20 | 10.85 | 10 | 0.40 | 0.22 | 5 | 1.30 | 0.97 | 5 | 0.00 | 0.00 | 10 |
| *Balanus rostratus (%)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 3.50 | 11.07 | 10 |
| *Balanus/Semibalanus spp. (%)* | 0.00 | 0.00 | 10 | 0.10 | 0.22 | 5 | 0.00 | 0.00 | 5 | 22.30 | 13.83 | 10 |
| *Balanus/Semibalanus spp., set (%)* | 0.25 | 0.26 | 10 | 0.50 | 0.00 | 5 | 1.40 | 3.13 | 5 | 0.80 | 0.86 | 10 |
| *Chthamalus dalli (% set)* | 0.10 | 0.21 | 10 | 0.90 | 1.19 | 5 | 2.50 | 2.40 | 5 | 0.00 | 0.00 | 10 |
| *Chthamalus dalli (%)* | 0.60 | 0.21 | 10 | 10.60 | 2.88 | 5 | 11.80 | 5.63 | 5 | 0.00 | 0.00 | 10 |
| Encrusting bryozoan (%) | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 10 |
| Encrusting sponge (%) | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 10 |
| *Halichondria panicea (%)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 10 |
| Herring eggs (%) | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 10 |
| *Littorina spp., eggs (%)* | 0.00 | 0.00 | 10 | 0.10 | 0.22 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 10 |
| *Mytilus sp. (% spat)* | 0.45 | 0.96 | 10 | 0.40 | 0.22 | 5 | 1.80 | 1.25 | 5 | 0.20 | 0.35 | 10 |
| *Mytilus cf. trossulus (%)* | 7.10 | 10.22 | 10 | 0.00 | 0.00 | 5 | 0.10 | 0.22 | 5 | 6.20 | 3.99 | 10 |
| *Nucella spp. (% eggs)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.10 | 0.22 | 5 | 0.00 | 0.00 | 10 |
| *Semibalanus balanoides (% set)* | 0.05 | 0.16 | 10 | 0.00 | 0.00 | 5 | 0.20 | 0.27 | 5 | 0.00 | 0.00 | 10 |
| *Semibalanus balanoides (%)* | 8.35 | 9.33 | 10 | 0.10 | 0.22 | 5 | 0.10 | 0.22 | 5 | 0.00 | 0.00 | 10 |
| *Semibalanus cariosus (% set)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.90 | 1.02 | 5 | 0.00 | 0.00 | 10 |
| *Semibalanus cariosus (%)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 1.60 | 1.92 | 5 | 0.00 | 0.00 | 10 |
| *Siphonaria thersites, eggs (%)* | 0.00 | 0.00 | 10 | 0.40 | 0.22 | 5 | 0.70 | 0.27 | 5 | 0.00 | 0.00 | 10 |
| Spirorbidae, unid. (%) | 0.00 | 0.00 | 10 | 0.10 | 0.22 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 10 |
| | | | | | | | | | | | | |
| Acarina | 0.00 | 0.00 | 10 | P | P | 3 | P | P | 4 | 0.00 | 0.00 | 10 |
| *Amphiporus spp.* | 0.00 | 0.00 | 10 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 10 |
| *Anthopleura artemisia* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.40 | 0.55 | 5 | 0.00 | 0.00 | 10 |
| *Anthopleura xanthogrammica* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 10 |
| *Clinocottus acuticeps* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 10 |
| *Emplectonema gracile* | 0.00 | 0.00 | 10 | 0.60 | 0.89 | 5 | 0.60 | 0.89 | 5 | 0.00 | 0.00 | 10 |
| *Evasterias troschelii* | 0.00 | 0.00 | 10 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 10 |
| Gammaridea, unid. | P | P | 9 | 0.00 | 0.00 | 5 | P | P | 4 | 0.00 | 0.00 | 10 |
| *Gnorimosphaeroma oregonensis* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 10 |
| *Hemigrapsus oregonensis* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 10 |
| *Insect larvae* | 0.00 | 0.00 | 10 | P | P | 4 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 10 |
| *Katharina tunicata* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 10 |
| *Lacuna spp.* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 10 |
| *Leptasterias hexactis* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 10 |
| *Littorina scutulata* | 289.40 | 139.79 | 10 | 52.20 | 70.02 | 5 | 10.20 | 10.40 | 5 | 0.00 | 0.00 | 10 |

**Table B-1-3 (continued)**

| Taxon | NW Bay Islet | | | NW Bay W Arm Cat 3 | | | NW Bay W Arm Cat ? | | | Omni Site | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count |
| *Littorina scutulata (juv.)* | 0.00 | 0.00 | 10 | 0.60 | 1.34 | 5 | 0.10 | 0.22 | 5 | 0.00 | 0.00 | 10 |
| *Littorina sitkana* | 37.50 | 56.68 | 10 | 2.40 | 3.58 | 5 | 19.20 | 18.83 | 5 | 0.00 | 0.00 | 10 |
| *Lottia pelta* | 1.50 | 4.06 | 10 | 1.00 | 1.22 | 5 | 1.20 | 1.30 | 5 | 0.00 | 0.00 | 10 |
| Lottiidae, unid. | 54.60 | 51.56 | 10 | 46.60 | 31.89 | 5 | 58.80 | 37.67 | 5 | 0.00 | 0.00 | 10 |
| Lottiidae, unid. (juv.) | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 10 |
| Nemertea, unid. | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 10 |
| *Notoplana sp.* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 10 |
| *Nucella lamellosa* | 0.00 | 0.00 | 10 | 3.80 | 3.90 | 5 | 8.40 | 9.32 | 5 | 0.00 | 0.00 | 10 |
| *Nucella lima* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 10 |
| *Onchidella borealis* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 10 |
| *Pagurus granosimanus* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 10 |
| *Pagurus hirsutiusculus* | 23.30 | 35.66 | 10 | 6.80 | 3.90 | 5 | 3.80 | 3.56 | 5 | 0.00 | 0.00 | 10 |
| *Pagurus spp.* | 0.00 | 0.00 | 10 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 10 |
| Pholidae/Stichaeidae | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 10 |
| *Pododesmus macroschismata* | 0.00 | 0.00 | 10 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 10 |
| Polychaeta, unid. | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 10 |
| *Searlesia dira* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 10 |
| *Siphonaria thersites* | 0.00 | 0.00 | 10 | 10.20 | 9.68 | 5 | 36.40 | 7.96 | 5 | 0.00 | 0.00 | 10 |
| *Strongylocentrotus droebachiensis* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 10 |
| *Tectura persona* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.40 | 0.89 | 5 | 0.00 | 0.00 | 10 |
| *Tectura scutum* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 10 |
| *Tonicella lineata* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 10 |
| *Volutharpa ampullacea* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 10 |
| | | | | | | | | | | | | |
| Encrusting coralline algae (dead) | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.60 | 1.34 | 5 | 0.00 | 0.00 | 10 |
| *Fucus gardneri (dead)* | 0.20 | 0.35 | 10 | 0.30 | 0.27 | 5 | 0.50 | 0.35 | 5 | 0.00 | 0.00 | 10 |
| | | | | | | | | | | | | |
| *Balanus crenatus (% dead)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 10 |
| *Balanus glandula (% dead)* | 0.25 | 0.26 | 10 | 0.40 | 0.22 | 5 | 0.10 | 0.22 | 5 | 0.00 | 0.00 | 10 |
| *Balanus/Semibalanus spp. (% dead)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.45 | 0.28 | 10 |
| *Balanus/Semibalanus spp. (% set, dead)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 10 |
| *Chthamalus dalli (% dead)* | 0.05 | 0.16 | 10 | 1.20 | 0.45 | 5 | 1.00 | 0.94 | 5 | 0.00 | 0.00 | 10 |
| *Chthamalus dalli (% set, dead)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 10 |
| *Mytilus cf. trossulus (dead)* | 0.90 | 1.45 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 10 |
| *Mytilus sp. (% set, dead)* | 0.00 | 0.00 | 10 | 0.60 | 1.34 | 5 | 14.20 | 9.07 | 5 | 0.00 | 0.00 | 10 |
| *Semibalanus balanoides (% dead)* | 0.35 | 0.34 | 10 | 0.10 | 0.22 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 10 |
| *Semibalanus balanoides (% set, dead)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 10 |
| *Semibalanus cariosus (% set, dead)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.20 | 0.27 | 5 | 0.00 | 0.00 | 10 |

**Table B-1-3 (continued)**

| Taxon | NW Bay Islet Mean | NW Bay Islet SD | NW Bay Islet Count | NW Bay W Arm Cat 3 Mean | NW Bay W Arm Cat 3 SD | NW Bay W Arm Cat 3 Count | NW Bay W Arm Cat ? Mean | NW Bay W Arm Cat ? SD | NW Bay W Arm Cat ? Count | Omni Site Mean | Omni Site SD | Omni Site Count |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Boulder/cobble (%) | 7.10 | 22.10 | 10 | 0.40 | 0.89 | 5 | 0.00 | 0.00 | 5 | 99.70 | 0.67 | 10 |
| Gravel/sand(%). | 0.40 | 1.26 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.30 | 0.67 | 10 |
| Mud (%) | 1.90 | 4.65 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 10 |
| Rock (%) | 90.60 | 23.51 | 10 | 99.60 | 0.89 | 5 | 100.00 | 0.00 | 5 | 0.00 | 0.00 | 10 |
| Water (%) | 2.70 | 4.60 | 10 | 4.00 | 6.28 | 5 | 1.60 | 3.05 | 5 | 0.00 | 0.00 | 10 |

**Table B-1-3 (continued)**

| Taxon | Outside Bay Mean | Outside Bay SD | Outside Bay Count | Snug Harbor Mean | Snug Harbor SD | Snug Harbor Count |
|---|---|---|---|---|---|---|
| *Acrosiphonia arcta* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| Black crust (maybe Hildenbrandia rubra) | 0.00 | 0.00 | 10 | 0.05 | 0.16 | 10 |
| *Blidingia minima* | 3.75 | 4.86 | 10 | 0.10 | 0.21 | 10 |
| Blue-green algae, crust | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| Blue-green algae, spheroids | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Callithamnion pikeanum* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Caulacanthus ustulatus* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Chaetomorpha tortuosa* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Cladophora sericea* | 1.00 | 2.20 | 10 | 0.10 | 0.21 | 10 |
| *Cryptosiphonia woodii* | 0.10 | 0.21 | 10 | 0.00 | 0.00 | 10 |
| *Dictyosiphon foeniculaceus* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Elachista fucicola* | 0.05 | 0.16 | 10 | 0.00 | 0.00 | 10 |
| Encrusting coralline algae | 0.30 | 0.67 | 10 | 0.00 | 0.00 | 10 |
| *Endocladia muricata* | 0.65 | 1.56 | 10 | 0.00 | 0.00 | 10 |
| Endozoic green algae | 0.10 | 0.21 | 10 | 0.15 | 0.24 | 10 |
| *Enteromorpha intestinalis* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| Flagelliform brown algae | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Fucus gardneri* | 53.90 | 26.92 | 10 | 31.80 | 27.38 | 10 |
| *Fucus gardneri (germlings)* | 0.95 | 1.14 | 10 | 0.95 | 0.60 | 10 |
| *Gloiopeltis furcata* | 2.05 | 2.44 | 10 | 0.75 | 0.54 | 10 |
| *Halosaccion glandiforme* | 1.95 | 1.80 | 10 | 0.00 | 0.00 | 10 |
| *Hildenbrandia rubra* | 1.15 | 1.83 | 10 | 0.10 | 0.21 | 10 |
| *Leathesia difformis* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Mastocarpus papillatus* | 1.60 | 2.97 | 10 | 0.05 | 0.16 | 10 |
| *Mazzaella spp.* | 0.15 | 0.34 | 10 | 0.00 | 0.00 | 10 |
| *Melanosiphon intestinalis* | 0.55 | 1.26 | 10 | 0.00 | 0.00 | 10 |
| *Monostroma grevillei* | 1.60 | 1.98 | 10 | 0.00 | 0.00 | 10 |
| *Neorhodomela oregona* | 0.40 | 0.66 | 10 | 0.05 | 0.16 | 10 |
| *Neorhodomela larix* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Odonthalia floccosa* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Palmaria callophylloides* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Petrocelis spp.* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Pilayella littoralis* | 8.15 | 9.94 | 10 | 1.75 | 4.70 | 10 |
| *Polysiphonia/Pterosiphonia spp.* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Porphyra spp.* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Pterosiphonia bipinnata* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Ralfsia spp.* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Rhodochorton purpureum* | 0.00 | 0.00 | 10 | 0.55 | 1.26 | 10 |
| *Soranthera ulvoidea* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |

**Table B-1-3 (continued)**

| Taxon | Outside Bay Mean | Outside Bay SD | Outside Bay Count | Snug Harbor Mean | Snug Harbor SD | Snug Harbor Count |
|---|---|---|---|---|---|---|
| *Sphacelaria rigidula* | 0.10 | 0.32 | 10 | 0.00 | 0.00 | 10 |
| *Ulva/Ulvaria spp.* | 0.15 | 0.34 | 10 | 0.00 | 0.00 | 10 |
| *Verrucaria spp.* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| | | | | | | |
| *Balanus glandula (% set)* | 0.00 | 0.00 | 10 | 0.15 | 0.24 | 10 |
| *Balanus glandula (%)* | 0.00 | 0.00 | 10 | 1.15 | 1.80 | 10 |
| *Balanus rostratus (%)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Balanus/Semibalanus spp. (%)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Balanus/Semibalanus spp., set (%)* | 1.05 | 1.61 | 10 | 0.05 | 0.16 | 10 |
| *Chthamalus dalli (% set)* | 2.75 | 4.80 | 10 | 0.35 | 0.34 | 10 |
| *Chthamalus dalli (%)* | 18.65 | 16.78 | 10 | 0.60 | 0.21 | 10 |
| Encrusting bryozoan (%) | 0.05 | 0.16 | 10 | 0.00 | 0.00 | 10 |
| Encrusting sponge (%) | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Halichondria panicea (%)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| Herring eggs (%) | 0.00 | 0.00 | 10 | 0.05 | 0.16 | 10 |
| *Littorina spp., eggs (%)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Mytilus sp. (% spat)* | 0.20 | 0.26 | 10 | 0.25 | 0.35 | 10 |
| *Mytilus cf. trossulus (%)* | 0.00 | 0.00 | 10 | 5.25 | 4.12 | 10 |
| *Nucella spp. (% eggs)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Semibalanus balanoides (% set)* | 0.05 | 0.16 | 10 | 0.35 | 0.34 | 10 |
| *Semibalanus balanoides (%)* | 0.40 | 0.94 | 10 | 2.90 | 3.63 | 10 |
| *Semibalanus cariosus (% set)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Semibalanus cariosus (%)* | 0.30 | 0.42 | 10 | 0.00 | 0.00 | 10 |
| *Siphonaria thersites, eggs (%)* | 0.15 | 0.24 | 10 | 0.00 | 0.00 | 10 |
| Spirorbidae, unid. (%) | 0.05 | 0.16 | 10 | 0.00 | 0.00 | 10 |
| | | | | | | |
| Acarina | P | P | 2 | P | P | 7 |
| *Amphiporus spp.* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Anthopleura artemisia* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Anthopleura xanthogrammica* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Clinocottus acuticeps* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Emplectonema gracile* | 0.10 | 0.32 | 10 | 0.00 | 0.00 | 10 |
| *Evasterias troschelii* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| Gammaridea, unid. | P | P | 8 | P | P | 9 |
| *Gnorimosphaeroma oregonensis* | 0.00 | 0.00 | 10 | 0.20 | 0.63 | 10 |
| *Hemigrapsus oregonensis* | 0.00 | 0.00 | 10 | 0.10 | 0.32 | 10 |
| *Insect larvae* | P | P | 9 | 0.00 | 0.00 | 10 |
| *Katharina tunicata* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Lacuna spp.* | 0.50 | 1.58 | 10 | 0.00 | 0.00 | 10 |
| *Leptasterias hexactis* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Littorina scutulata* | 9.30 | 21.56 | 10 | 44.00 | 46.11 | 10 |

## Table B-1-3 (continued)

| Taxon | Outside Bay Mean | Outside Bay SD | Outside Bay Count | Snug Harbor Mean | Snug Harbor SD | Snug Harbor Count |
|---|---|---|---|---|---|---|
| *Littorina scutulata (juv.)* | P | P | 9 | 0.00 | 0.00 | 10 |
| *Littorina sitkana* | 0.40 | 1.26 | 10 | 44.00 | 35.67 | 10 |
| *Lottia pelta* | 1.00 | 2.00 | 10 | 0.60 | 1.26 | 10 |
| Lottiidae, unid. | 22.80 | 29.85 | 10 | 1.60 | 4.40 | 10 |
| Lottiidae, unid. (juv.) | 0.00 | 0.00 | 10 | 28.40 | 24.91 | 10 |
| Nemertea, unid. | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Notoplana sp.* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Nucella lamellosa* | 4.30 | 8.14 | 10 | 0.00 | 0.00 | 10 |
| *Nucella lima* | 0.00 | 0.00 | 10 | 3.10 | 3.81 | 10 |
| *Onchidella borealis* | 0.10 | 0.32 | 10 | 0.00 | 0.00 | 10 |
| *Pagurus granosimanus* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Pagurus hirsutiusculus* | 0.60 | 0.84 | 10 | 5.80 | 6.05 | 10 |
| *Pagurus spp.* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| Pholidae/Stichaeidae | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Pododesmus macroschismata* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| Polychaeta, unid. | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Searlesia dira* | 0.00 | 0.00 | 10 | 0.10 | 0.32 | 10 |
| *Siphonaria thersites* | 15.60 | 16.54 | 10 | 0.00 | 0.00 | 10 |
| *Strongylocentrotus droebachiensis* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Tectura persona* | 0.00 | 0.00 | 10 | 0.30 | 0.48 | 10 |
| *Tectura scutum* | 0.70 | 1.16 | 10 | 3.70 | 3.97 | 10 |
| *Tonicella lineata* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Volutharpa ampullacea* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| | | | | | | |
| Encrusting coralline algae (dead) | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Fucus gardneri (dead)* | 0.20 | 0.26 | 10 | 0.10 | 0.21 | 10 |
| | | | | | | |
| *Balanus crenatus (% dead)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Balanus glandula (% dead)* | 0.00 | 0.00 | 10 | 0.50 | 0.41 | 10 |
| *Balanus/Semibalanus spp. (% dead)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Balanus/Semibalanus spp. (% set, dead)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Chthamalus dalli (% dead)* | 1.00 | 0.85 | 10 | 0.10 | 0.21 | 10 |
| *Chthamalus dalli (% set, dead)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Mytilus cf. trossulus (dead)* | 0.00 | 0.00 | 10 | 6.40 | 6.24 | 10 |
| *Mytilus sp. (% set, dead)* | 0.10 | 0.21 | 10 | 0.00 | 0.00 | 10 |
| *Semibalanus balanoides (% dead)* | 0.15 | 0.24 | 10 | 0.70 | 0.63 | 10 |
| *Semibalanus balanoides (% set, dead)* | 0.00 | 0.00 | 10 | 0.05 | 0.16 | 10 |
| *Semibalanus cariosus (% set, dead)* | 0.25 | 0.35 | 10 | 0.00 | 0.00 | 10 |

**Table B-1-3 (continued)**

| Taxon | Outside Bay | | | Snug Harbor | | |
|---|---|---|---|---|---|---|
| | Mean | SD | Count | Mean | SD | Count |
| Boulder/cobble (%) | 90.00 | 31.62 | 10 | 88.10 | 24.26 | 10 |
| Gravel/sand(%) | 0.00 | 0.00 | 10 | 4.40 | 4.03 | 10 |
| Mud (%) | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| Rock (%) | 10.00 | 31.62 | 10 | 7.50 | 23.72 | 10 |
| Water (%) | 0.00 | 0.00 | 10 | 0.20 | 0.63 | 10 |

Table B-1-4 Rocky lower intertidal epibiota, June 1994.

| Taxon | Crab Bay Mean | Crab Bay SD | Crab Bay Count | Elrington East Mean | Elrington East SD | Elrington East Count | Elrington West Mean | Elrington West SD | Elrington West Count | Eshamy Bay Mean | Eshamy Bay SD | Eshamy Bay Count |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Acrosiphonia arcta* | 3.25 | 3.17 | 10 | 0.60 | 1.34 | 5 | 0.06 | 0.17 | 9 | 0.05 | 0.16 | 10 |
| *Alaria spp.* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| *Antithamnionella pacifica* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 3.60 | 7.71 | 10 |
| Black crust (maybe Hildenbrandia rubra) | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| *Blidingia minima* | 0.00 | 0.00 | 10 | 4.40 | 6.43 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| Blue-green algae, spheroids | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| *Callithamnion pikeanum* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.20 | 0.63 | 10 |
| *Callophyllis flabellulata* | 0.00 | 0.00 | 10 | 0.10 | 0.22 | 5 | 0.11 | 0.33 | 9 | 0.00 | 0.00 | 10 |
| *Chaetomorpha melagonium* | 0.10 | 0.21 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.05 | 0.16 | 10 |
| *Cladophora sericea* | 8.90 | 8.46 | 10 | 8.10 | 7.45 | 5 | 5.78 | 6.33 | 9 | 9.05 | 10.57 | 10 |
| *Corallina frondescens* | 0.45 | 0.69 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 3.45 | 3.45 | 10 |
| *Corallina officianalis* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| *Cryptosiphonia woodii* | 6.70 | 4.42 | 10 | 0.00 | 0.00 | 5 | 4.22 | 4.06 | 9 | 8.10 | 7.80 | 10 |
| *Dictyosiphon foeniculaceus* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.50 | 1.58 | 10 |
| *Dumontia contorta* | 0.05 | 0.16 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| *Elachista fucicola* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 1.00 | 1.25 | 10 |
| Encrusting coralline algae | 2.20 | 2.86 | 10 | 0.00 | 0.00 | 5 | 0.06 | 0.17 | 9 | 3.80 | 1.81 | 10 |
| Encrusting green algae | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.20 | 0.63 | 10 |
| Encrusting red algae | 0.05 | 0.16 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| Endozoic green algae | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| *Enteromorpha linza* | 0.00 | 0.00 | 10 | 3.30 | 4.52 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| *Eudesme virescens* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.05 | 0.16 | 10 |
| *Fucus gardneri* | 10.90 | 9.71 | 10 | 43.00 | 26.83 | 5 | 59.44 | 25.69 | 9 | 48.50 | 24.95 | 10 |
| *Fucus gardneri (germlings)* | 0.00 | 0.00 | 10 | 0.30 | 0.27 | 5 | 0.17 | 0.25 | 9 | 0.55 | 0.90 | 10 |
| *Gloiopeltis furcata* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.06 | 0.17 | 9 | 0.00 | 0.00 | 10 |
| *Halosaccion glandiforme* | 11.50 | 5.48 | 10 | 0.00 | 0.00 | 5 | 0.11 | 0.22 | 9 | 5.20 | 4.26 | 10 |
| *Hildenbrandia rubra* | 0.00 | 0.00 | 10 | 2.20 | 2.59 | 5 | 5.28 | 8.49 | 9 | 8.15 | 10.11 | 10 |
| *Iridaea heterocarpa* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.10 | 0.32 | 10 |
| *Laminaria groenlandica* | 1.80 | 4.73 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| *Leathesia difformis* | 0.15 | 0.24 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.20 | 0.26 | 10 |
| *Mastocarpus papillatus* | 0.50 | 0.85 | 10 | 0.00 | 0.00 | 5 | 0.89 | 2.67 | 9 | 2.85 | 4.44 | 10 |
| *Mazzaella spp.* | 8.50 | 6.59 | 10 | 3.70 | 3.07 | 5 | 7.44 | 13.13 | 9 | 8.95 | 6.53 | 10 |
| *Melanosiphon intestinalis* | 0.45 | 0.64 | 10 | 2.20 | 2.36 | 5 | 2.83 | 4.02 | 9 | 0.60 | 0.81 | 10 |
| *Microcladia borealis* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| *Monostroma grevillei* | 29.90 | 22.17 | 10 | 0.30 | 0.45 | 5 | 1.44 | 2.60 | 9 | 3.75 | 2.07 | 10 |
| *Neorhodomela oregona* | 5.15 | 7.27 | 10 | 1.20 | 1.64 | 5 | 7.83 | 7.05 | 9 | 5.05 | 2.89 | 10 |
| *Neorhodomela larix* | 1.20 | 2.20 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 8.65 | 10.49 | 10 |
| *Odonthalia floccosa* | 3.50 | 4.67 | 10 | 0.00 | 0.00 | 5 | 1.17 | 3.32 | 9 | 0.00 | 0.00 | 10 |
| *Palmaria callophylloides* | 0.10 | 0.32 | 10 | 0.10 | 0.22 | 5 | 0.50 | 0.97 | 9 | 0.05 | 0.16 | 10 |
| *Palmaria hecatensis* | 5.70 | 7.23 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.10 | 0.32 | 10 |

Table B-1-4 (continued)

| Taxon | Crab Bay Mean | SD | Count | Elrington East Mean | SD | Count | Elrington West Mean | SD | Count | Eshamy Bay Mean | SD | Count |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Palmaria mollis* | 1.55 | 3.04 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.75 | 1.03 | 10 |
| *Petalonia fascia* | 0.00 | 0.00 | 10 | 0.40 | 0.89 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| *Petrocelis spp.* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| *Phycodrys riggii* | 9.20 | 7.91 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.75 | 1.55 | 10 |
| *Pilayella littoralis* | 3.45 | 6.21 | 10 | 11.20 | 5.22 | 5 | 15.33 | 10.98 | 9 | 1.90 | 2.13 | 10 |
| *Polysiphonia pacifica* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.95 | 2.50 | 10 |
| *Polysiphonia senticulosa* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| *Polysiphonia spp.* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| *Polysiphonia/Pterosiphonia spp.* | 0.00 | 0.00 | 10 | 0.40 | 0.55 | 5 | 0.00 | 0.00 | 9 | 0.10 | 0.32 | 10 |
| *Porphyra spp.* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| *Pterosiphonia bipinnata* | 0.20 | 0.63 | 10 | 0.00 | 0.00 | 5 | 2.39 | 3.60 | 9 | 11.00 | 9.89 | 10 |
| *Ptilota filicina* | 4.50 | 3.98 | 10 | 0.00 | 0.00 | 5 | 0.06 | 0.17 | 9 | 1.45 | 2.48 | 10 |
| *Punctaria cf. hesperia* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.10 | 0.32 | 10 |
| *Ralfsia fungiformis* | 0.05 | 0.16 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.30 | 0.67 | 10 |
| *Ralfsia spp.* | 0.20 | 0.63 | 10 | 4.00 | 4.06 | 5 | 4.56 | 5.34 | 9 | 3.50 | 7.72 | 10 |
| *Rhodochorton purpureum* | 0.05 | 0.16 | 10 | 1.20 | 2.17 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| *Scagelia pylaisaei* | 0.05 | 0.16 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.85 | 1.58 | 10 |
| *Scytosiphon lomentaria* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| *Soranthera ulvoidea* | 0.25 | 0.35 | 10 | 0.10 | 0.22 | 5 | 0.28 | 0.36 | 9 | 0.25 | 0.35 | 10 |
| *Sphacelaria rigidula* | 0.65 | 1.89 | 10 | 5.20 | 4.82 | 5 | 1.78 | 4.97 | 9 | 3.60 | 3.57 | 10 |
| *Tokidadendron kurilensis* | 2.40 | 2.12 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.85 | 1.00 | 10 |
| *Ulva sp.* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.30 | 0.63 | 10 |
| *Ulva/Ulvaria spp.* | 12.60 | 14.12 | 10 | 0.70 | 1.30 | 5 | 3.28 | 4.93 | 9 | 0.10 | 0.32 | 10 |
| *Ulvaria spp.* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| *Verrucaria spp.* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| | | | | | | | | | | | | |
| *Alcyonidium spp. (%)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| *Balanus crenatus (%)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| *Balanus glandula (% set)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.06 | 0.17 | 9 | 0.00 | 0.00 | 10 |
| *Balanus glandula (%)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.06 | 0.17 | 9 | 0.00 | 0.00 | 10 |
| *Balanus rostratus (%)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| *Balanus/Semibalanus spp. (%)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| *Balanus/Semibalanus spp., set (%)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| Campanulariidae (%) | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.05 | 0.16 | 10 |
| *Chthamalus dalli (% set)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.06 | 0.17 | 9 | 0.00 | 0.00 | 10 |
| *Chthamalus dalli (%)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.11 | 0.22 | 9 | 1.45 | 2.51 | 10 |
| *Cryptosula pallasiana (%)* | 6.60 | 7.55 | 10 | 0.40 | 0.89 | 5 | 0.00 | 0.00 | 9 | 4.35 | 7.70 | 10 |
| *Cryptosula spp. (%)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| Encrusting bryozoan (%) | 0.10 | 0.32 | 10 | 0.10 | 0.22 | 5 | 0.22 | 0.44 | 9 | 0.10 | 0.21 | 10 |
| Encrusting sponge (%) | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |

Table B-1-4 (continued)

| Taxon | Crab Bay | | | Elrington East | | | Elrington West | | | Eshamy Bay | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count |
| *Halichondria panicea (%)* | 0.15 | 0.34 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| Hydroids unid. (%) | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.05 | 0.16 | 10 |
| *Hippothoa hyalina (%)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| *Littorina spp., eggs (%)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| *Musculus spp. (% spat)* | 0.05 | 0.16 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.10 | 0.21 | 10 |
| *Mytilus cf. trossulus (% spat)* | 0.00 | 0.00 | 10 | 0.10 | 0.22 | 5 | 0.06 | 0.17 | 9 | 0.15 | 0.24 | 10 |
| *Mytilus cf. trossulus (%)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 4.22 | 12.67 | 9 | 0.00 | 0.00 | 10 |
| *Nucella spp. (% eggs)* | 0.05 | 0.16 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.10 | 0.32 | 10 |
| Porifera, unid. orange (%) | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| *Scrupocellaria sp. (%)* | 0.25 | 0.26 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| *Semibalanus balanoides (% set)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| *Semibalanus balanoides (%)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| *Semibalanus cariosus (% set)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| *Semibalanus cariosus (%)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.11 | 0.22 | 9 | 0.05 | 0.16 | 10 |
| Spirorbidae, unid. (%) | 1.00 | 0.75 | 10 | 0.30 | 0.27 | 5 | 0.22 | 0.26 | 9 | 0.60 | 0.21 | 10 |
| | | | | | | | | | | | | |
| Acarina | P | P | 3 | P | P | 4 | P | P | 2 | P | P | 4 |
| *Amphiporus spp.* | 0.70 | 0.82 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.50 | 1.08 | 10 |
| *Anthopleura artemisia* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| Anthopleura spp. | 0.10 | 0.32 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| Anthozoa, unid. | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| *Buccinum baeri* | 0.10 | 0.32 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| Cottidae, unid. | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| *Cryptobranchia concentrica* | 0.00 | 0.00 | 10 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| *Cucumaria vegae* | 0.00 | 0.00 | 10 | 4.00 | 3.54 | 5 | 0.89 | 1.69 | 9 | 0.00 | 0.00 | 10 |
| *Dermasterias imbricata* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.30 | 0.67 | 10 |
| *Emplectonema gracile* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| *Evasterias troschelii* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| Gammaridea, unid. | P | P | 6 | P | P | 1 | P | P | 6 | P | P | 6 |
| *Gnorimosphaeroma oregonensis* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| *Gobiesox spp.* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.11 | 0.33 | 9 | 0.00 | 0.00 | 10 |
| *Hiatella arctica* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.50 | 1.58 | 10 |
| Insect larvae | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| *Katharina tunicata* | 0.00 | 0.00 | 10 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| *Lacuna spp.* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.11 | 0.33 | 9 | 2.70 | 5.01 | 10 |
| *Lacuna spp. (set)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| *Leptasterias hexactis* | 0.30 | 0.67 | 10 | 0.00 | 0.00 | 5 | 0.67 | 1.00 | 9 | 0.00 | 0.00 | 10 |
| *Littorina scutulata* | 0.00 | 0.00 | 10 | 0.20 | 0.45 | 5 | 0.78 | 1.72 | 9 | 0.30 | 0.67 | 10 |
| *Littorina sitkana* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 8.89 | 22.98 | 9 | 0.00 | 0.00 | 10 |
| *Lottia pelta* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |

Table B-1-4 (continued)

| | Crab Bay | | | Elrington East | | | Elrington West | | | Eshamy Bay | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Taxon** | **Mean** | **SD** | **Count** | **Mean** | **SD** | **Count** | **Mean** | **SD** | **Count** | **Mean** | **SD** | **Count** |
| *Mytilus sp. (% set, dead)* | 0.20 | 0.42 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.20 | 0.63 | 10 |
| *Semibalanus balanoides (% dead)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| *Semibalanus cariosus (% set, dead)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.06 | 0.17 | 9 | 0.00 | 0.00 | 10 |
| Spirorbidae (% dead) | 0.00 | 0.00 | 10 | 0.10 | 0.22 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| | | | | | | | | | | | | |
| Boulder/cobble (%) | 5.90 | 15.75 | 10 | 57.00 | 34.93 | 5 | 69.22 | 29.78 | 9 | 19.50 | 41.13 | 10 |
| Gravel/sand(%) | 4.50 | 12.57 | 10 | 25.00 | 26.93 | 5 | 30.78 | 29.78 | 9 | 0.60 | 1.58 | 10 |
| Mud (%) | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| Rock (%) | 89.60 | 28.14 | 10 | 18.00 | 40.25 | 5 | 0.00 | 0.00 | 9 | 79.90 | 42.11 | 10 |
| Water (%) | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 12.70 | 23.68 | 10 |

**Table B-1-4 (continued)**

| Taxon | Crab Bay | | | Elrington East | | | Elrington West | | | Eshamy Bay | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count |
| Lottiidae, unid. | 0.00 | 0.00 | 10 | 1.00 | 1.41 | 5 | 0.67 | 1.12 | 9 | 0.70 | 2.21 | 10 |
| Lottiidae, unid. (juv.) | 1.10 | 2.13 | 10 | 0.00 | 0.00 | 5 | 15.11 | 26.34 | 9 | 2.00 | 5.01 | 10 |
| *Margarites marginatus* | 0.30 | 0.48 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| *Metridium senile* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| *Mitrella spp.* | 1.20 | 2.30 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.20 | 0.63 | 10 |
| *Musculus spp.* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.10 | 0.32 | 10 |
| Nemertea, unid. | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.11 | 0.33 | 9 | 0.00 | 0.00 | 10 |
| *Notoplana sp.* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| *Nucella lamellosa* | 0.90 | 1.29 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.20 | 0.42 | 10 |
| *Nucella lamellosa (juv.)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| *Nucella lima* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.11 | 0.33 | 9 | 0.00 | 0.00 | 10 |
| *Onchidella borealis* | 0.00 | 0.00 | 10 | 0.80 | 1.79 | 5 | 17.67 | 19.31 | 9 | 0.00 | 0.00 | 10 |
| *Pagurus granosimanus* | 0.00 | 0.00 | 10 | 0.60 | 0.89 | 5 | 0.22 | 0.67 | 9 | 0.00 | 0.00 | 10 |
| *Pagurus hirsutiusculus* | 0.20 | 0.42 | 10 | 28.00 | 20.24 | 5 | 17.89 | 24.59 | 9 | 4.90 | 4.89 | 10 |
| *Paranemertes peregrina* | 0.10 | 0.32 | 10 | 0.20 | 0.45 | 5 | 0.44 | 0.53 | 9 | 0.00 | 0.00 | 10 |
| *Pentidotea wosnesenskii* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| Pholidae/Stichaeidae | 0.50 | 0.71 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.10 | 0.32 | 10 |
| Pholidae/Stichaeidae ( juv.) | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| *Pisaster ochraceus* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| *Pugettia dalli* | 0.20 | 0.63 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.20 | 0.63 | 10 |
| *Pycnopodia helianthoides* | 0.10 | 0.32 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.20 | 0.63 | 10 |
| *Searlesia dira* | 4.50 | 3.60 | 10 | 0.60 | 0.55 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| *Serpula vermicularis* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.10 | 0.32 | 10 |
| *Strongylocentrotus droebachiensis* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.10 | 0.32 | 10 |
| *Tectura persona* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| *Tectura scutum* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| *Tonicella lineata* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.50 | 0.85 | 10 |
| *Volutharpa ampullacea* | 0.00 | 0.00 | 10 | 1.00 | 1.00 | 5 | 0.33 | 0.50 | 9 | 0.00 | 0.00 | 10 |
| | | | | | | | | | | | | |
| *Cladophora spp. (dead)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| *Corallina spp. (dead)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.05 | 0.16 | 10 |
| *Fucus gardneri (dead)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.11 | 0.22 | 9 | 0.05 | 0.16 | 10 |
| | | | | | | | | | | | | |
| *Balanus crenatus (% dead)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| *Balanus glandula (% dead)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.06 | 0.17 | 9 | 0.00 | 0.00 | 10 |
| *Balanus rostratus (% dead)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| *Balanus/Semibalanus spp. (% set, dead)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.00 | 0.00 | 10 |
| *Chthamalus dalli (% dead)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.20 | 0.26 | 10 |
| *Hiatella arctica (dead)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 9 | 0.50 | 0.85 | 10 |
| *Mytilus cf. trossulus (dead)* | 0.10 | 0.32 | 10 | 0.60 | 0.89 | 5 | 0.33 | 0.71 | 9 | 0.00 | 0.00 | 10 |

Table B-1-4 (continued)

| Taxon | Hogg Bay | | | Mussel Beach N. | | | NW Bay Islet | | | Outside Bay | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count |
| *Palmaria mollis* | 0.60 | 1.26 | 10 | 0.30 | 0.42 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Petalonia fascia* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.05 | 0.16 | 10 | 0.00 | 0.00 | 10 |
| *Petrocelis spp.* | 1.00 | 2.11 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Phycodrys riggii* | 2.30 | 3.29 | 10 | 1.25 | 1.77 | 10 | 0.05 | 0.16 | 10 | 7.00 | 6.66 | 10 |
| *Pilayella littoralis* | 6.30 | 9.14 | 10 | 5.60 | 9.02 | 10 | 7.90 | 11.28 | 10 | 1.90 | 2.38 | 10 |
| *Polysiphonia pacifica* | 0.35 | 0.34 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Polysiphonia senticulosa* | 0.00 | 0.00 | 10 | 0.10 | 0.32 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Polysiphonia spp.* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 1.50 | 1.78 | 10 |
| *Polysiphonia/Pterosiphonia spp.* | 0.00 | 0.00 | 10 | 0.05 | 0.16 | 10 | 0.00 | 0.00 | 10 | 2.00 | 6.32 | 10 |
| *Porphyra spp.* | 0.10 | 0.21 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Pterosiphonia bipinnata* | 4.35 | 6.34 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 2.10 | 2.81 | 10 |
| *Ptilota filicina* | 2.85 | 4.43 | 10 | 1.75 | 2.68 | 10 | 0.00 | 0.00 | 10 | 3.55 | 6.16 | 10 |
| *Punctaria cf. hesperia* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Ralfsia fungiformis* | 0.00 | 0.00 | 10 | 0.25 | 0.35 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Ralfsia spp.* | 0.95 | 1.57 | 10 | 2.30 | 2.39 | 10 | 7.95 | 6.94 | 10 | 0.00 | 0.00 | 10 |
| *Rhodochorton purpureum* | 0.00 | 0.00 | 10 | 1.50 | 4.74 | 10 | 0.15 | 0.34 | 10 | 0.05 | 0.16 | 10 |
| *Scagelia pylaisaei* | 0.10 | 0.21 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 3.50 | 5.06 | 10 |
| *Scytosiphon lomentaria* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Soranthera ulvoidea* | 0.60 | 0.91 | 10 | 0.10 | 0.21 | 10 | 0.00 | 0.00 | 10 | 0.30 | 0.26 | 10 |
| *Sphacelaria rigidula* | 0.00 | 0.00 | 10 | 0.05 | 0.16 | 10 | 0.20 | 0.35 | 10 | 4.10 | 5.32 | 10 |
| *Tokidadendron kurilensis* | 0.90 | 0.97 | 10 | 1.15 | 1.49 | 10 | 0.00 | 0.00 | 10 | 13.70 | 7.82 | 10 |
| *Ulva sp.* | 0.15 | 0.34 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Ulva/Ulvaria spp.* | 0.00 | 0.00 | 10 | 4.60 | 7.99 | 10 | 1.45 | 1.80 | 10 | 4.50 | 4.77 | 10 |
| *Ulvaria spp.* | 21.90 | 13.40 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Verrucaria spp.* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.05 | 0.16 | 10 | 0.00 | 0.00 | 10 |
| | | | | | | | | | | | | |
| *Alcyonidium spp. (%)* | 0.25 | 0.63 | 10 | 0.10 | 0.21 | 10 | 0.05 | 0.16 | 10 | 0.00 | 0.00 | 10 |
| *Balanus crenatus (%)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Balanus glandula (% set)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Balanus glandula (%)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.20 | 0.26 | 10 | 0.00 | 0.00 | 10 |
| *Balanus rostratus (%)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Balanus/Semibalanus spp. (%)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.05 | 0.16 | 10 | 0.00 | 0.00 | 10 |
| *Balanus/Semibalanus spp., set (%)* | 10.15 | 9.64 | 10 | 0.05 | 0.16 | 10 | 0.30 | 0.63 | 10 | 0.10 | 0.21 | 10 |
| Campanulariidae (%) | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Chthamalus dalli (% set)* | 0.30 | 0.95 | 10 | 0.00 | 0.00 | 10 | 0.05 | 0.16 | 10 | 0.00 | 0.00 | 10 |
| *Chthamalus dalli (%)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.50 | 0.94 | 10 | 0.05 | 0.16 | 10 |
| *Cryptosula pallasiana (%)* | 3.70 | 8.38 | 10 | 0.20 | 0.63 | 10 | 0.00 | 0.00 | 10 | 1.10 | 1.60 | 10 |
| *Cryptosula spp. (%)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.50 | 1.58 | 10 | 0.00 | 0.00 | 10 |
| Encrusting bryozoan (%) | 0.20 | 0.63 | 10 | 2.05 | 2.17 | 10 | 0.15 | 0.34 | 10 | 0.50 | 0.97 | 10 |
| Encrusting sponge (%) | 0.05 | 0.16 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |

Table B-1-4 (continued)

| Taxon | Hogg Bay Mean | Hogg Bay SD | Hogg Bay Count | Mussel Beach N. Mean | Mussel Beach N. SD | Mussel Beach N. Count | NW Bay Islet Mean | NW Bay Islet SD | NW Bay Islet Count | Outside Bay Mean | Outside Bay SD | Outside Bay Count |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Halichondria panicea (%)* | 0.30 | 0.95 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| Hydroids unid. (%) | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Hippothoa hyalina (%)* | 0.85 | 1.29 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Littorina spp., eggs (%)* | 0.00 | 0.00 | 10 | 0.05 | 0.16 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Musculus spp. (% spat)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.15 | 0.24 | 10 | 0.00 | 0.00 | 10 |
| *Mytilus cf. trossulus (% spat)* | 0.65 | 0.63 | 10 | 0.05 | 0.16 | 10 | 0.20 | 0.26 | 10 | 0.25 | 0.26 | 10 |
| *Mytilus cf. trossulus (%)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Nucella spp. (% eggs)* | 0.00 | 0.00 | 10 | 0.10 | 0.21 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| Porifera, unid. orange (%) | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Scrupocellaria sp. (%)* | 0.30 | 0.63 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Semibalanus balanoides (% set)* | 0.00 | 0.00 | 10 | 0.15 | 0.34 | 10 | 0.00 | 0.00 | 10 | 0.40 | 1.26 | 10 |
| *Semibalanus balanoides (%)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.15 | 0.24 | 10 | 0.00 | 0.00 | 10 |
| *Semibalanus cariosus (% set)* | 0.05 | 0.16 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Semibalanus cariosus (%)* | 29.60 | 29.84 | 10 | 0.10 | 0.32 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| Spirorbidae, unid. (%) | 0.20 | 0.42 | 10 | 0.20 | 0.26 | 10 | 0.20 | 0.26 | 10 | 0.55 | 0.16 | 10 |
| Acarina | P | P | 4 | P | P | 9 | P | P | 5 | P | P | 0 |
| *Amphiporus spp.* | 0.80 | 0.92 | 10 | 0.10 | 0.32 | 10 | 0.30 | 0.95 | 10 | 0.40 | 0.70 | 10 |
| *Anthopleura artemisia* | 5.00 | 10.18 | 10 | 0.10 | 0.32 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| Anthopleura spp. | 3.20 | 5.75 | 10 | 0.50 | 1.08 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| Anthozoa, unid. | 0.00 | 0.00 | 10 | 0.20 | 0.63 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Buccinum baeri* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| Cottidae, unid. | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.10 | 0.32 | 10 | 0.00 | 0.00 | 10 |
| *Cryptobranchia concentrica* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Cucumaria vegae* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Dermasterias imbricata* | 0.10 | 0.32 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Emplectonema gracile* | 0.10 | 0.32 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Evasterias troschelii* | 0.00 | 0.00 | 10 | 0.70 | 1.06 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| Gammaridea, unid. | P | P | 2 | P | P | 4 | P | P | 7 | P | P | 3 |
| *Gnorimosphaeroma oregonensis* | 0.20 | 0.42 | 10 | 0.00 | 0.00 | 10 | 0.10 | 0.32 | 10 | 0.00 | 0.00 | 10 |
| *Gobiesox spp.* | 0.10 | 0.32 | 10 | 0.10 | 0.32 | 10 | 0.00 | 0.00 | 10 | 0.20 | 0.42 | 10 |
| *Hiatella arctica* | 0.30 | 0.67 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.20 | 0.63 | 10 |
| Insect larvae | P | P | 9 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Katharina tunicata* | 0.40 | 0.97 | 10 | 0.60 | 0.97 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Lacuna spp.* | 0.10 | 0.32 | 10 | P | P | 8 | 0.10 | 0.32 | 10 | 0.70 | 1.89 | 10 |
| *Lacuna spp. (set)* | 0.00 | 0.00 | 10 | 0.05 | 0.16 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Leptasterias hexactis* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Littorina scutulata* | 0.10 | 0.32 | 10 | 0.00 | 0.00 | 10 | 10.00 | 14.69 | 10 | 0.00 | 0.00 | 10 |
| *Littorina sitkana* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.20 | 0.42 | 10 | 0.00 | 0.00 | 10 |
| *Lottia pelta* | 0.30 | 0.67 | 10 | 0.00 | 0.00 | 10 | 0.70 | 1.06 | 10 | 0.00 | 0.00 | 10 |

Table B-1-4 (continued)

| | Hogg Bay | | | Mussel Beach N. | | | NW Bay Islet | | | Outside Bay | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Taxon** | **Mean** | **SD** | **Count** | **Mean** | **SD** | **Count** | **Mean** | **SD** | **Count** | **Mean** | **SD** | **Count** |
| Lottiidae, unid. | 1.00 | 1.63 | 10 | 2.20 | 2.25 | 10 | 20.20 | 44.06 | 10 | 0.10 | 0.32 | 10 |
| Lottiidae, unid. (juv.) | 6.60 | 6.28 | 10 | 0.00 | 0.00 | 10 | 39.60 | 59.09 | 10 | 0.00 | 0.00 | 10 |
| *Margarites marginatus* | 0.60 | 1.35 | 10 | 0.30 | 0.48 | 10 | 0.00 | 0.00 | 10 | 0.10 | 0.32 | 10 |
| *Metridium senile* | 0.00 | 0.00 | 10 | 0.10 | 0.32 | 10 | 0.00 | 0.00 | 10 | 0.10 | 0.32 | 10 |
| *Mitrella spp.* | 0.00 | 0.00 | 10 | 0.40 | 1.26 | 10 | 0.00 | 0.00 | 10 | 0.10 | 0.32 | 10 |
| *Musculus spp.* | 0.20 | 0.63 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| Nemertea, unid. | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Notoplana sp.* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.10 | 0.32 | 10 | 0.00 | 0.00 | 10 |
| *Nucella lamellosa* | 37.90 | 36.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.30 | 0.48 | 10 |
| *Nucella lamellosa (juv.)* | 0.10 | 0.32 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Nucella lima* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Onchidella borealis* | 0.50 | 1.27 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Pagurus granosimanus* | 0.00 | 0.00 | 10 | 0.80 | 1.62 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Pagurus hirsutiusculus* | 2.00 | 2.49 | 10 | 4.60 | 3.47 | 10 | 10.70 | 13.25 | 10 | 0.40 | 0.52 | 10 |
| *Paranemertes peregrina* | 0.00 | 0.00 | 10 | 0.10 | 0.32 | 10 | 0.20 | 0.42 | 10 | 0.00 | 0.00 | 10 |
| *Pentidotea wosnesenskii* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| Pholidae/Stichaeidae | 0.00 | 0.00 | 10 | 0.10 | 0.32 | 10 | 0.10 | 0.32 | 10 | 0.10 | 0.32 | 10 |
| Pholidae/Stichaeidae ( juv.) | 0.00 | 0.00 | 10 | 0.30 | 0.67 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Pisaster ochraceus* | 0.10 | 0.32 | 10 | 0.00 | 0.00 | 10 | 0.10 | 0.32 | 10 | 0.00 | 0.00 | 10 |
| *Pugettia dalli* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.40 | 0.52 | 10 |
| *Pycnopodia helianthoides* | 0.00 | 0.00 | 10 | 0.10 | 0.32 | 10 | 0.00 | 0.00 | 10 | 0.30 | 0.48 | 10 |
| *Searlesia dira* | 0.00 | 0.00 | 10 | 2.60 | 1.71 | 10 | 0.30 | 0.48 | 10 | 0.00 | 0.00 | 10 |
| *Serpula vermicularis* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Strongylocentrotus droebachiensis* | 0.00 | 0.00 | 10 | 0.10 | 0.32 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Tectura persona* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Tectura scutum* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.50 | 1.58 | 10 | 0.00 | 0.00 | 10 |
| *Tonicella lineata* | 0.00 | 0.00 | 10 | 0.20 | 0.42 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Volutharpa ampullacea* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| | | | | | | | | | | | | |
| *Cladophora spp. (dead)* | 0.00 | 0.00 | 10 | 0.05 | 0.16 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Corallina spp. (dead)* | 0.00 | 0.00 | 10 | 0.60 | 1.26 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Fucus gardneri (dead)* | 0.00 | 0.00 | 10 | 0.45 | 0.83 | 10 | 0.15 | 0.24 | 10 | 0.00 | 0.00 | 10 |
| | | | | | | | | | | | | |
| *Balanus crenatus (% dead)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Balanus glandula (% dead)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.15 | 0.34 | 10 | 0.00 | 0.00 | 10 |
| *Balanus rostratus (% dead)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Balanus/Semibalanus spp. (% set, dead)* | 0.50 | 0.71 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Chthamalus dalli (% dead)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Hiatella arctica (dead)* | 0.20 | 0.63 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| *Mytilus cf. trossulus (dead)* | 7.40 | 13.99 | 10 | 0.30 | 0.67 | 10 | 0.10 | 0.32 | 10 | 0.60 | 1.35 | 10 |

Table B-1-4 (continued)

| Taxon | Hogg Bay | | | Mussel Beach N. | | | NW Bay Islet | | | Outside Bay | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count |
| *Mytilus sp. (% set, dead)* | 37.20 | 83.05 | 10 | 0.00 | 0.00 | 10 | 0.10 | 0.32 | 10 | 0.20 | 0.63 | 10 |
| *Semibalanus balanoides (% dead)* | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.15 | 0.24 | 10 | 0.00 | 0.00 | 10 |
| *Semibalanus cariosus (% set, dead)* | 0.30 | 0.67 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| Spirorbidae (% dead) | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| Boulder/cobble (%) | 10.00 | 31.62 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 70.00 | 48.30 | 10 |
| Gravel/sand(%) | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 2.00 | 6.32 | 10 | 0.50 | 1.58 | 10 |
| Mud (%) | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 | 0.00 | 0.00 | 10 |
| Rock (%) | 90.00 | 31.62 | 10 | 100.00 | 0.00 | 10 | 98.00 | 6.32 | 10 | 29.50 | 47.52 | 10 |
| Water (%) | 2.30 | 3.89 | 10 | 1.80 | 2.62 | 10 | 1.50 | 4.74 | 10 | 0.00 | 0.00 | 10 |

**Table B-2-1 Mixed-soft middle intertidal epibiota at Northwest Bay West Arm, June 1994.**

| | NW Bay W Arm (mid) | | |
|---|---|---|---|
| **Taxon** | **Mean** | **SD** | **Count** |
| Endozoic green algae | 0.15 | 0.24 | 10 |
| *Fucus gardneri* | 0.20 | 0.63 | 10 |
| *Fucus gardneri (germlings)* | 0.05 | 0.16 | 10 |
| *Gloiopeltis furcata* | 0.05 | 0.16 | 10 |
| *Neorhodomela oregona* | 0.30 | 0.95 | 10 |
| *Ralfsia spp.* | 0.15 | 0.24 | 10 |
| | | | |
| *Balanus glandula (% set)* | 0.05 | 0.16 | 10 |
| *Balanus glandula (%)* | 7.30 | 2.79 | 10 |
| *Chthamalus dalli (%)* | 0.65 | 0.75 | 10 |
| *Semibalanus balanoides (% set)* | 0.40 | 0.39 | 10 |
| *Semibalanus balanoides (%)* | 1.70 | 1.62 | 10 |
| | | | |
| Acarina | P | P | 8 |
| *Littorina scutulata* | 359.40 | 196.88 | 10 |
| *Littorina sitkana* | 76.40 | 81.46 | 10 |
| *Lottia pelta* | 1.50 | 1.84 | 10 |
| Lottiidae, unid. | 6.20 | 4.37 | 10 |
| *Mytilus cf. trossulus (% spat)* | 0.50 | 0.82 | 10 |
| *Mytilus cf. trossulus (%)* | 8.80 | 5.29 | 10 |
| *Pagurus hirsutiusculus* | 0.20 | 0.63 | 10 |
| *Tectura persona* | 4.30 | 3.83 | 10 |
| | | | |
| *Balanus glandula (% dead)* | 0.50 | 0.33 | 10 |
| *Chthamalus dalli (% dead)* | 0.05 | 0.16 | 10 |
| *Mytilus cf. trossulus (dead)* | 1.50 | 1.90 | 10 |
| *Semibalanus balanoides (% dead)* | 0.15 | 0.24 | 10 |
| | | | |
| Boulder/cobble (%) | 81.50 | 29.25 | 10 |
| Gravel/sand(%) | 18.50 | 29.25 | 10 |
| Water (%) | 0.30 | 0.95 | 10 |

**Table B-2-2 Mixed-soft lower intertidal epibiota at Northwest Bay West Arm, June 1994.**

| | NW Bay W Arm (low) | | |
|---|---|---|---|
| Taxon | Mean | S. D. | Count |
| *Acrosiphonia arcta* | 3.70 | 3.46 | 10 |
| *Cladophora sericea* | 5.05 | 8.79 | 10 |
| *Cryptosiphonia woodii* | 0.40 | 1.26 | 10 |
| *Dictyosiphon foeniculaceus* | 0.10 | 0.21 | 10 |
| *Enteromorpha intestinalis* | 0.20 | 0.26 | 10 |
| *Fucus gardneri* | 10.90 | 12.59 | 10 |
| *Fucus gardneri (germlings)* | 0.65 | 0.53 | 10 |
| *Gloiopeltis furcata* | 2.40 | 2.29 | 10 |
| *Halosaccion glandiforme* | 0.50 | 0.67 | 10 |
| *Melanosiphon intestinalis* | 2.15 | 4.68 | 10 |
| *Monostroma grevillei* | 8.25 | 18.77 | 10 |
| *Neorhodomela oregona* | 2.80 | 5.69 | 10 |
| *Pilayella littoralis* | 1.55 | 1.61 | 10 |
| *Polysiphonia pacifica* | 1.45 | 3.08 | 10 |
| *Pterosiphonia bipinnata* | 0.10 | 0.32 | 10 |
| *Punctaria lobata* | 0.10 | 0.32 | 10 |
| *Ralfsia spp.* | 0.60 | 0.32 | 10 |
| *Scytosiphon lomentaria* | 0.05 | 0.16 | 10 |
| *Soranthera ulvoidea* | 0.10 | 0.21 | 10 |
| *Sphacelaria rigidula* | 0.15 | 0.34 | 10 |
| *Ulva/Ulvaria spp.* | 0.10 | 0.32 | 10 |
| | | | |
| *Balanus crenatus (% set)* | 0.05 | 0.16 | 10 |
| *Balanus crenatus (%)* | 0.10 | 0.21 | 10 |
| *Balanus glandula (% set)* | 0.15 | 0.24 | 10 |
| *Balanus glandula (%)* | 0.05 | 0.16 | 10 |
| *Chthamalus dalli (% set)* | 0.20 | 0.35 | 10 |
| *Chthamalus dalli (%)* | 0.45 | 0.28 | 10 |
| *Nucella spp. (% eggs)* | 0.05 | 0.16 | 10 |
| *Semibalanus balanoides (%)* | 0.05 | 0.16 | 10 |
| Spirorbidae, unid. (%) | 0.10 | 0.21 | 10 |
| | | | |
| *Gnorimosphaeroma oregonensis* | 0.10 | 0.32 | 10 |
| *Lacuna spp.* | 0.10 | 0.32 | 10 |
| *Leptasterias hexactis* | 0.10 | 0.32 | 10 |
| *Littorina scutulata* | 297.70 | 138.66 | 10 |
| *Littorina sitkana* | 0.90 | 1.37 | 10 |
| *Lottia pelta* | 1.80 | 2.74 | 10 |
| Lottiidae, unid. (juv.) | 66.10 | 31.72 | 10 |
| *Margarites marginatus* | 0.20 | 0.42 | 10 |
| *Mytilus cf. trossulus (% spat)* | 0.55 | 1.26 | 10 |
| *Mytilus cf. trossulus (%)* | 7.50 | 14.77 | 10 |
| *Pagurus hirsutiusculus* | 4.70 | 4.42 | 10 |
| *Paranemertes peregrina* | 0.10 | 0.32 | 10 |
| Pholidae/Stichaeidae | 0.20 | 0.42 | 10 |
| *Pholis laeta* | 0.20 | 0.42 | 10 |
| *Pholis ornata* | 0.10 | 0.32 | 10 |

**Table B-2-2 (continued).**

| Taxon | NW Bay W Arm (low) | | |
|---|---|---|---|
| | Mean | S. D. | Count |
| *Fucus gardneri (dead)* | 0.20 | 0.35 | 10 |
| | | | |
| *Balanus glandula (% dead)* | 0.10 | 0.21 | 10 |
| *Chthamalus dalli (% dead)* | 0.15 | 0.24 | 10 |
| *Mytilus cf. trossulus (dead)* | 2.10 | 3.18 | 10 |
| | | | |
| Boulder/cobble (%) | 35.80 | 25.09 | 10 |
| Gravel/sand(%) | 64.20 | 25.09 | 10 |

# Appendix C

# Infauna Data

**Table C-1 Average number of macroinfaunal taxa in cores from lower intertidal zone at sites sampled in Prince William Sound during June 1994.**

| | Category 1 | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Bainbridge Bight | | | Crab Bay | | | Outside Bay | | | Sheep Bay | | | Category 1 | |
| Taxon | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count | Mean | SD |
| *Acmira catherinae* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.05 | 0.10 |
| *Allorchestes angustus* | 0.40 | 0.89 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.10 | 0.20 |
| *Alvania compacta* | 0.60 | 1.34 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 4.20 | 3.77 | 5 | 1.25 | 1.98 |
| Ampharetidae | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.05 | 0.10 |
| Ampithoe | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.10 | 0.12 |
| *Ampithoe dalli* | 0.20 | 0.45 | 5 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.15 | 0.10 |
| *Ampithoe kussakina* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 3.00 | 4.12 | 5 | 0.75 | 1.50 |
| *Anisogammarus* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Anisogammarus pugettensis* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 1.00 | 1.73 | 5 | 0.25 | 0.50 |
| *Aphelochaeta spp. indet.* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 4.80 | 4.09 | 5 | 0.00 | 0.00 | 5 | 1.20 | 2.40 |
| *Aplacophora* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Armandia brevis* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.05 | 0.10 |
| *Asabellides sibirica* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Barantolla americana* | 0.20 | 0.45 | 5 | 2.00 | 1.22 | 5 | 0.20 | 0.45 | 5 | 0.40 | 0.55 | 5 | 0.70 | 0.87 |
| *Bittium spp.* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Brada sachalina* | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.05 | 0.10 |
| *Capitella capitata complex* | 3.60 | 4.51 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.95 | 1.77 |
| *Chaetozone* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Chaetozone acuta* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Chiridota* | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.10 | 0.12 |
| *Cingula sp. 1* | 17.40 | 38.91 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 4.35 | 8.70 |
| *Cingula sp. 2* | 2.20 | 3.19 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.55 | 1.10 |
| *Cirratulus cirratus* | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.05 | 0.10 |
| *Cirratulus spectabilis* | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.10 | 0.12 |
| *Corophium* | 0.00 | 0.00 | 5 | 0.60 | 1.34 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.15 | 0.30 |
| *Corophium brevis* | 0.00 | 0.00 | 5 | 5.40 | 8.88 | 5 | 0.00 | 0.00 | 5 | 1.20 | 2.68 | 5 | 1.65 | 2.56 |
| *Cumella vulgaris* | 0.80 | 0.45 | 5 | 26.40 | 36.64 | 5 | 0.20 | 0.45 | 5 | 0.60 | 0.89 | 5 | 7.00 | 12.94 |
| *Diplodonta aleutica* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| Dorvilleidae | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Echiurus echiurus alaskanus* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Eobrolgus spinosus* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.05 | 0.10 |
| *Eogammarus confervicolus* | 0.40 | 0.89 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.10 | 0.20 |
| *Eteone* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |

* Taxa dropped from calculation of H', N, and S.

**Table C-1 (continued)**

| | Category 1 | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Bainbridge Bight | | | Crab Bay | | | Outside Bay | | | Sheep Bay | | | Category 1 | |
| Taxon | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count | Mean | SD |
| *Eteone longa* | 1.60 | 1.14 | 5 | 0.80 | 0.84 | 5 | 0.80 | 0.84 | 5 | 0.20 | 0.45 | 5 | 0.85 | 0.57 |
| *Eteone spetsbergensis* | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.05 | 0.10 |
| *Eulalia viridis* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Fabricia stellaris stellaris* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Fabriciola berkeleyi* | 0.60 | 1.34 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.15 | 0.30 |
| *Fartulum* | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 1.20 | 2.17 | 5 | 9.00 | 14.16 | 5 | 2.60 | 4.30 |
| * Gammaridea | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.10 | 0.12 |
| *Gammaroporeia alaskensis* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| * Gastropoda | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Glycera capitata* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.40 | 0.55 | 5 | 1.00 | 0.71 | 5 | 0.35 | 0.47 |
| *Glycinde polygnatha* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.60 | 0.89 | 5 | 1.60 | 1.52 | 5 | 0.55 | 0.75 |
| *Harmothoe imbricata* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.05 | 0.10 |
| Hesionidae | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.05 | 0.10 |
| * Holothuroidea | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.60 | 1.34 | 5 | 0.20 | 0.28 |
| *Ianiropsis* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.05 | 0.10 |
| *Ianiropsis kincaidi* | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.40 | 0.89 | 5 | 0.15 | 0.19 |
| *Laphania boecki* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Leitoscoloplos pugettensis* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.80 | 0.84 | 5 | 0.20 | 0.45 | 5 | 0.25 | 0.38 |
| *Lepidonotus squamatus* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.60 | 1.34 | 5 | 0.40 | 0.55 | 5 | 0.25 | 0.30 |
| *Leptochelia savignyi* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.40 | 0.89 | 5 | 0.00 | 0.00 | 5 | 0.10 | 0.20 |
| *Leptosynapta* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 2.40 | 2.30 | 5 | 1.20 | 1.64 | 5 | 0.90 | 1.15 |
| *Lumbrineris* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.05 | 0.10 |
| *Macoma balthica* | 0.00 | 0.00 | 5 | 4.60 | 4.98 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 1.15 | 2.30 |
| *Macoma inquinata* | 1.20 | 1.30 | 5 | 1.00 | 1.73 | 5 | 1.80 | 2.49 | 5 | 3.80 | 1.79 | 5 | 1.95 | 1.28 |
| *Mediomastus* | 1.00 | 2.24 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.25 | 0.50 |
| *Mediomastus californiensis* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.40 | 0.89 | 5 | 1.00 | 1.41 | 5 | 0.35 | 0.47 |
| *Megamphopus* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Melita* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.05 | 0.10 |
| *Melita californica* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Melita dentata* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.80 | 1.79 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.40 |
| *Micranellum crebrincinctum* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Mysella tumida* | 3.20 | 2.86 | 5 | 0.40 | 0.55 | 5 | 37.80 | 11.99 | 5 | 6.60 | 3.05 | 5 | 12.00 | 17.39 |
| *Naineris quadricuspida* | 10.20 | 13.48 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 2.55 | 5.10 |

* Taxa dropped from calculation of H', N, and S.

Table C-1 (continued)

| | Category 1 | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Bainbridge Bight | | | Crab Bay | | | Outside Bay | | | Sheep Bay | | | Category 1 | |
| Taxon | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count | Mean | SD |
| *Neoamphitrite robusta* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| Nereidae | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Nereis* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Nereis vexillosa* | 0.40 | 0.89 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.10 | 0.20 |
| *Nereis zonata* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Nerilla digitata* | 0.60 | 1.34 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.20 | 0.28 |
| *Odostomia* | 0.40 | 0.55 | 5 | 0.20 | 0.45 | 5 | 0.40 | 0.55 | 5 | 3.00 | 2.35 | 5 | 1.00 | 1.34 |
| *Ophelia limacina* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.05 | 0.10 |
| *Orbiniella nuda* | 33.00 | 51.06 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 8.25 | 16.50 |
| *Owenia fusiformis* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 4.20 | 2.77 | 5 | 1.05 | 2.10 |
| Oweniidae | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.05 | 0.10 |
| *Paramoera sp. 1* | 0.60 | 1.34 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.60 | 0.89 | 5 | 0.30 | 0.35 |
| *Paramoera sp. 2* | 0.00 | 0.00 | 5 | 0.40 | 0.89 | 5 | 0.00 | 0.00 | 5 | 5.80 | 3.27 | 5 | 1.55 | 2.84 |
| *Pectinaria granulata* | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.60 | 0.89 | 5 | 1.20 | 1.10 | 5 | 0.50 | 0.53 |
| *Phascolosoma agassizi* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Pherusa plumosa* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.40 | 0.55 | 5 | 0.10 | 0.20 |
| *Pholoe minuta* | 75.00 | 56.23 | 5 | 0.00 | 0.00 | 5 | 5.20 | 2.77 | 5 | 2.20 | 1.92 | 5 | 20.60 | 36.33 |
| Phoxocephalidae | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| Platyhelminthes | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Platynereis bicanalicula* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.40 | 0.55 | 5 | 0.00 | 0.00 | 5 | 0.10 | 0.20 |
| Polychaeta | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Polydora brachycephala* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.05 | 0.10 |
| *Polydora giardi* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Polydora quadrilobata* | 6.00 | 6.96 | 5 | 0.00 | 0.00 | 5 | 2.20 | 4.38 | 5 | 0.00 | 0.00 | 5 | 2.05 | 2.83 |
| *Polydora socialis* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.05 | 0.10 |
| * Polynoidae | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 1.20 | 1.79 | 5 | 0.20 | 0.45 | 5 | 0.35 | 0.57 |
| *Priapulus caudatus* | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.05 | 0.10 |
| *Prionospio cirrifera* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.05 | 0.10 |
| *Prionospio steenstrupi* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 1.20 | 2.17 | 5 | 0.30 | 0.60 |
| *Protodorvillea gracilis* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.40 | 0.55 | 5 | 0.10 | 0.20 |
| *Protothaca staminea* | 1.00 | 1.00 | 5 | 1.20 | 1.10 | 5 | 4.40 | 1.34 | 5 | 4.20 | 1.64 | 5 | 2.70 | 1.85 |
| *Pygospio elegans* | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.05 | 0.10 |
| *Rhynchospio glutaea* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.40 | 0.89 | 5 | 0.00 | 0.00 | 5 | 0.10 | 0.20 |

* Taxa dropped from calculation of H', N, and S.

## Table C-1 (continued)

| | Category 1 | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Bainbridge Bight | | | Crab Bay | | | Outside Bay | | | Sheep Bay | | | Category 1 | |
| Taxon | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count | Mean | SD |
| * Rissoidae | 8.20 | 16.71 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 2.05 | 4.10 |
| * Sabellidae | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.05 | 0.10 |
| *Saccocirrus eroticus* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.60 | 0.89 | 5 | 0.15 | 0.30 |
| *Saxidomus gigantea* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.60 | 0.55 | 5 | 0.20 | 0.28 |
| *Scalibregma inflatum* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Scolelepis squamatus* | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.05 | 0.10 |
| *Sphaerodoropsis sphaerulifer* | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.05 | 0.10 |
| *Sphaerosyllis pirifera* | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.10 | 0.12 |
| *Spinulogammarus subcarinatus* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Spio* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Spio filicornis* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.05 | 0.10 |
| * Spionidae | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.05 | 0.10 |
| *Syllis elongata* | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 1.80 | 3.49 | 5 | 0.60 | 1.34 | 5 | 0.65 | 0.81 |
| *Tellina* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.05 | 0.10 |
| *Tellina modesta* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| Tellinidae | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| Terebellidae | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.05 | 0.10 |
| Turbellaria | 0.00 | 0.00 | 5 | 0.40 | 0.89 | 5 | 0.00 | 0.00 | 5 | 0.40 | 0.89 | 5 | 0.20 | 0.23 |
| Mean diversity (H') | 1.50 | | | 1.25 | | | 1.72 | | | 2.54 | | | 1.75 | 0.56 |
| Mean abundance (N) | 162.61 | | | 41.48 | | | 71.14 | | | 63.85 | | | 84.77 | 53.41 |
| Mean number of taxa (S) | 13.07 | | | 6.45 | | | 13.75 | | | 18.84 | | | 13.03 | 5.09 |
| Meiofauna | | | | | | | | | | | | | | |
| Harpacticoida | 9.40 | 16.01 | 5 | 2.40 | 5.37 | 5 | 19.80 | 27.24 | 5 | 7.00 | 10.34 | 5 | 9.65 | 7.36 |
| Nematoda | 39.20 | 70.58 | 5 | 6.60 | 7.50 | 5 | 50.20 | 71.40 | 5 | 32.20 | 16.30 | 5 | 32.05 | 18.51 |
| Oligochaeta | 29.80 | 16.62 | 5 | 44.00 | 31.92 | 5 | 1.20 | 2.17 | 5 | 9.60 | 7.83 | 5 | 21.15 | 19.39 |
| Ostracoda | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |

* Taxa dropped from calculation of H', N, and S.

Table C-1 (continued)

| | Category 2 | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Block Island | | | Herring Bay | | | Mussel Beach S | | | Snug Harbor | | | Category 2 | |
| Taxon | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count | Mean | SD |
| *Acmira catherinae* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Allorchestes angustus* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Alvania compacta* | 1.80 | 1.30 | 5 | 1.20 | 1.79 | 5 | 2.80 | 2.28 | 5 | 0.00 | 0.00 | 5 | 1.45 | 1.17 |
| Ampharetidae | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| Ampithoe | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Ampithoe dalli* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Ampithoe kussakina* | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 3.40 | 5.64 | 5 | 1.60 | 1.67 | 5 | 1.30 | 1.57 |
| *Anisogammarus* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Anisogammarus pugettensis* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Aphelochaeta spp. indet.* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Aplacophora* | 0.00 | 0.00 | 5 | 0.40 | 0.89 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.10 | 0.20 |
| *Armandia brevis* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Asabellides sibirica* | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.05 | 0.10 |
| *Barantolla americana* | 0.60 | 0.55 | 5 | 1.80 | 1.48 | 5 | 0.20 | 0.45 | 5 | 0.40 | 0.55 | 5 | 0.75 | 0.72 |
| *Bittium spp.* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 1.40 | 1.52 | 5 | 0.35 | 0.70 |
| *Brada sachalina* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Capitella capitata complex* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Chaetozone* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Chaetozone acuta* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.40 | 0.55 | 5 | 0.10 | 0.20 |
| *Chiridota* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Cingula sp. 1* | 0.00 | 0.00 | 5 | 89.20 | 37.18 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 22.30 | 44.60 |
| *Cingula sp. 2* | 0.00 | 0.00 | 5 | 48.00 | 49.98 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 12.00 | 24.00 |
| *Cirratulus cirratus* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Cirratulus spectabilis* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 3.60 | 4.83 | 5 | 0.80 | 1.79 | 5 | 1.10 | 1.71 |
| *Corophium* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.05 | 0.10 |
| *Corophium brevis* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Cumella vulgaris* | 4.20 | 6.69 | 5 | 20.00 | 20.90 | 5 | 0.00 | 0.00 | 5 | 2.20 | 2.05 | 5 | 6.60 | 9.10 |
| *Diplodonta aleutica* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 1.20 | 2.68 | 5 | 0.00 | 0.00 | 5 | 0.30 | 0.60 |
| Dorvilleidae | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.05 | 0.10 |
| *Echiurus echiurus alaskanus* | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.10 | 0.12 |
| *Eobrolgus spinosus* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Eogammarus confervicolus* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Eteone* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.05 | 0.10 |

* Taxa dropped from calculation of H', N, and S.

## Table C-1 (continued)

| | Category 2 | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Block Island | | | Herring Bay | | | Mussel Beach S | | | Snug Harbor | | | Category 2 | |
| Taxon | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count | Mean | SD |
| *Eteone longa* | 3.40 | 5.94 | 5 | 10.40 | 16.47 | 5 | 27.00 | 28.04 | 5 | 1.80 | 1.48 | 5 | 10.65 | 11.52 |
| *Eteone spetsbergensis* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.40 | 0.89 | 5 | 0.60 | 1.34 | 5 | 0.25 | 0.30 |
| *Eulalia viridis* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.40 | 0.55 | 5 | 0.00 | 0.00 | 5 | 0.10 | 0.20 |
| *Fabricia stellaris stellaris* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.60 | 0.89 | 5 | 0.00 | 0.00 | 5 | 0.15 | 0.30 |
| *Fabriciola berkeleyi* | 0.00 | 0.00 | 5 | 0.80 | 1.30 | 5 | 0.00 | 0.00 | 5 | 25.80 | 25.03 | 5 | 6.65 | 12.77 |
| *Fartulum* | 1.20 | 2.68 | 5 | 0.20 | 0.45 | 5 | 33.40 | 46.79 | 5 | 4.20 | 7.26 | 5 | 9.75 | 15.86 |
| * Gammaridea | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 1.00 | 1.41 | 5 | 0.20 | 0.45 | 5 | 0.35 | 0.44 |
| *Gammaroporeia alaskensis* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| * Gastropoda | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.05 | 0.10 |
| *Glycera capitata* | 0.80 | 0.84 | 5 | 0.00 | 0.00 | 5 | 1.20 | 1.30 | 5 | 0.00 | 0.00 | 5 | 0.50 | 0.60 |
| *Glycinde polygnatha* | 0.40 | 0.55 | 5 | 0.80 | 1.30 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.30 | 0.38 |
| *Harmothoe imbricata* | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.05 | 0.10 |
| Hesionidae | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.05 | 0.10 |
| * Holothuroidea | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.40 | 0.89 | 5 | 0.00 | 0.00 | 5 | 0.15 | 0.19 |
| *Ianiropsis* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Ianiropsis kincaidi* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.80 | 1.30 | 5 | 0.20 | 0.40 |
| *Laphania boecki* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 5.60 | 10.92 | 5 | 0.00 | 0.00 | 5 | 1.40 | 2.80 |
| *Leitoscoloplos pugettensis* | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.05 | 0.10 |
| *Lepidonotus squamatus* | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.05 | 0.10 |
| *Leptochelia savignyi* | 0.00 | 0.00 | 5 | 0.40 | 0.89 | 5 | 1.00 | 1.73 | 5 | 6.60 | 11.70 | 5 | 2.00 | 3.09 |
| *Leptosynapta* | 0.40 | 0.89 | 5 | 0.00 | 0.00 | 5 | 1.20 | 1.30 | 5 | 0.20 | 0.45 | 5 | 0.45 | 0.53 |
| *Lumbrineris* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Macoma balthica* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.40 | 0.89 | 5 | 0.00 | 0.00 | 5 | 0.10 | 0.20 |
| *Macoma inquinata* | 9.40 | 5.13 | 5 | 1.00 | 1.41 | 5 | 0.60 | 0.89 | 5 | 0.00 | 0.00 | 5 | 2.75 | 4.45 |
| *Mediomastus* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Mediomastus californiensis* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Megamphopus* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.05 | 0.10 |
| *Melita* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.05 | 0.10 |
| *Melita californica* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 1.20 | 1.10 | 5 | 0.00 | 0.00 | 5 | 0.30 | 0.60 |
| *Melita dentata* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Micranellum crebrincinctum* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.05 | 0.10 |
| *Mysella tumida* | 11.20 | 8.14 | 5 | 5.60 | 6.35 | 5 | 14.20 | 11.95 | 5 | 0.00 | 0.00 | 5 | 7.75 | 6.28 |
| *Naineris quadricuspida* | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.40 | 0.55 | 5 | 0.00 | 0.00 | 5 | 0.15 | 0.19 |

* Taxa dropped from calculation of H', N, and S.

Table C-1 (continued)

| | Category 2 | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Block Island | | | Herring Bay | | | Mussel Beach S | | | Snug Harbor | | | Category 2 | |
| Taxon | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count | Mean | SD |
| * Rissoidae | 0.00 | 0.00 | 5 | 46.00 | 16.76 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 11.50 | 23.00 |
| * Sabellidae | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.10 | 0.12 |
| *Saccocirrus eroticus* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Saxidomus gigantea* | 0.60 | 0.89 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.28 |
| *Scalibregma inflatum* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Scolelepis squamatus* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Sphaerodoropsis sphaerulifer* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Sphaerosyllis pirifera* | 0.60 | 0.89 | 5 | 0.00 | 0.00 | 5 | 13.20 | 13.70 | 5 | 0.20 | 0.45 | 5 | 3.50 | 6.47 |
| *Spinulogammarus subcarinatus* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Spio* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Spio filicornis* | 0.40 | 0.89 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.10 | 0.20 |
| * Spionidae | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Syllis elongata* | 1.00 | 1.41 | 5 | 0.00 | 0.00 | 5 | 2.80 | 2.59 | 5 | 0.00 | 0.00 | 5 | 0.95 | 1.32 |
| *Tellina* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Tellina modesta* | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.05 | 0.10 |
| Tellinidae | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.80 | 1.10 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.40 |
| Terebellidae | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| Turbellaria | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.40 | 0.55 | 5 | 0.00 | 0.00 | 5 | 0.10 | 0.20 |
| | | | | | | | | | | | | | | |
| Mean diversity (H') | 2.12 | | | 1.38 | | | 2.00 | | | 1.60 | | | 1.78 | 0.34 |
| Mean abundance (N) | 62.25 | | | 192.53 | | | 147.87 | | | 54.90 | | | 114.39 | 67.04 |
| Mean number of taxa (S) | 13.02 | | | 11.42 | | | 18.98 | | | 9.40 | | | 13.21 | 4.13 |
| | | | | | | | | | | | | | | |
| Meiofauna | | | | | | | | | | | | | | |
| Harpacticoida | 17.80 | 33.71 | 5 | 42.20 | 29.22 | 5 | 39.20 | 20.81 | 5 | 3.60 | 2.88 | 5 | 25.70 | 18.31 |
| Nematoda | 8.00 | 11.45 | 5 | 68.60 | 56.55 | 5 | 82.80 | 33.37 | 5 | 6.60 | 6.27 | 5 | 41.50 | 39.92 |
| Oligochaeta | 20.00 | 25.58 | 5 | 12.00 | 10.79 | 5 | 6.40 | 5.68 | 5 | 5.40 | 8.38 | 5 | 10.95 | 6.70 |
| Ostracoda | 0.00 | 0.00 | 5 | 2.80 | 5.72 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.70 | 1.40 |

* Taxa dropped from calculation of H', N, and S.

## Table C-1 (continued)

| | Category 2 | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Block Island | | | Herring Bay | | | Mussel Beach S | | | Snug Harbor | | | Category 2 | |
| Taxon | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count | Mean | SD |
| *Neoamphitrite robusta* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.05 | 0.10 |
| Nereidae | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.05 | 0.10 |
| *Nereis* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.05 | 0.10 |
| *Nereis vexillosa* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Nereis zonata* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Nerilla digitata* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.05 | 0.10 |
| *Odostomia* | 2.00 | 2.92 | 5 | 1.60 | 1.52 | 5 | 0.20 | 0.45 | 5 | 0.40 | 0.89 | 5 | 1.05 | 0.89 |
| *Ophelia limacina* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.40 | 0.55 | 5 | 0.00 | 0.00 | 5 | 0.10 | 0.20 |
| *Orbiniella nuda* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Owenia fusiformis* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.40 | 0.89 | 5 | 0.00 | 0.00 | 5 | 0.10 | 0.20 |
| Oweniidae | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.20 | 0.45 | 5 | 0.10 | 0.12 |
| *Paramoera sp. 1* | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.05 | 0.10 |
| *Paramoera sp. 2* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.05 | 0.10 |
| *Pectinaria granulata* | 5.80 | 3.70 | 5 | 0.00 | 0.00 | 5 | 0.40 | 0.55 | 5 | 0.00 | 0.00 | 5 | 1.55 | 2.84 |
| *Phascolosoma agassizi* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 3.20 | 2.95 | 5 | 0.00 | 0.00 | 5 | 0.80 | 1.60 |
| *Pherusa plumosa* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Pholoe minuta* | 4.40 | 4.16 | 5 | 12.80 | 24.20 | 5 | 16.40 | 12.03 | 5 | 5.20 | 4.49 | 5 | 9.70 | 5.85 |
| Phoxocephalidae | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.05 | 0.10 |
| Platyhelminthes | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Platynereis bicanalicula* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| Polychaeta | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Polydora brachycephala* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.05 | 0.10 |
| *Polydora giardi* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.05 | 0.10 |
| *Polydora quadrilobata* | 4.20 | 7.19 | 5 | 2.40 | 1.52 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 1.65 | 2.04 |
| *Polydora socialis* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| * Polynoidae | 0.60 | 0.55 | 5 | 0.20 | 0.45 | 5 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.25 | 0.25 |
| *Priapulus caudatus* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Prionospio cirrifera* | 0.40 | 0.55 | 5 | 0.20 | 0.45 | 5 | 0.60 | 0.89 | 5 | 0.20 | 0.45 | 5 | 0.35 | 0.19 |
| *Prionospio steenstrupi* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Protodorvillea gracilis* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Protothaca staminea* | 7.60 | 6.31 | 5 | 0.60 | 0.89 | 5 | 6.40 | 4.83 | 5 | 0.40 | 0.89 | 5 | 3.75 | 3.79 |
| *Pygospio elegans* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Rhynchospio glutaea* | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.05 | 0.10 |

* Taxa dropped from calculation of H', N, and S.

Table C-1 (continued)

| | Category 3 | | | | | | | | | | | | Category 3 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Elrington West | | | NW Bay W Arm | | | Shelter Bay | | | Sleepy Bay | | | Category 3 | |
| Taxon | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count | Mean | SD |
| *Acmira catherinae* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Allorchestes angustus* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.05 | 0.10 |
| *Alvania compacta* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 1.40 | 2.19 | 5 | 0.40 | 0.67 |
| Ampharetidae | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| Ampithoe | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.40 | 0.55 | 5 | 0.10 | 0.20 |
| *Ampithoe dalli* | 1.80 | 3.03 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.45 | 0.90 |
| *Ampithoe kussakina* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Anisogammarus* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.05 | 0.10 |
| *Anisogammarus pugettensis* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Aphelochaeta spp. indet.* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Aplacophora* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Armandia brevis* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Asabellides sibirica* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Barantolla americana* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Bittium spp.* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Brada sachalina* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Capitella capitata complex* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Chaetozone* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.05 | 0.10 |
| *Chaetozone acuta* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Chiridota* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Cingula sp. 1* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Cingula sp. 2* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Cirratulus cirratus* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Cirratulus spectabilis* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 1.20 | 2.17 | 5 | 0.30 | 0.60 |
| *Corophium* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.05 | 0.10 |
| *Corophium brevis* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Cumella vulgaris* | 10.80 | 6.76 | 5 | 4.40 | 3.13 | 5 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 3.85 | 5.06 |
| *Diplodonta aleutica* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| Dorvilleidae | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Echiurus echiurus alaskanus* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Eobrolgus spinosus* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Eogammarus confervicolus* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Eteone* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |

* Taxa dropped from calculation of H', N, and S.

**Table C-1 (continued)**

| | Category 3 | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Elrington West | | | NW Bay W Arm | | | Shelter Bay | | | Sleepy Bay | | | Category 3 | |
| Taxon | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count | Mean | SD |
| *Eteone longa* | 1.00 | 1.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 2.20 | 2.68 | 5 | 0.80 | 1.05 |
| *Eteone spetsbergensis* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.05 | 0.10 |
| *Eulalia viridis* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Fabricia stellaris stellaris* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Fabriciola berkeleyi* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Fartulum* | 0.00 | 0.00 | 5 | 1.00 | 1.00 | 5 | 0.00 | 0.00 | 5 | 23.80 | 47.13 | 5 | 6.20 | 11.74 |
| * Gammaridea | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.40 | 0.89 | 5 | 0.15 | 0.19 |
| *Gammaroporeia alaskensis* | 6.40 | 6.62 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 1.60 | 3.20 |
| * Gastropoda | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Glycera capitata* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 1.60 | 3.58 | 5 | 0.40 | 0.80 |
| *Glycinde polygnatha* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Harmothoe imbricata* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| Hesionidae | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| * Holothuroidea | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Ianiropsis* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 2.00 | 2.83 | 5 | 0.00 | 0.00 | 5 | 0.50 | 1.00 |
| *Ianiropsis kincaidi* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.80 | 1.10 | 5 | 0.20 | 0.45 | 5 | 0.25 | 0.38 |
| *Laphania boecki* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Leitoscoloplos pugettensis* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Lepidonotus squamatus* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Leptochelia savignyi* | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.05 | 0.10 |
| *Leptosynapta* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Lumbrineris* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Macoma balthica* | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.05 | 0.10 |
| *Macoma inquinata* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.05 | 0.10 |
| *Mediomastus* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Mediomastus californiensis* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Megamphopus* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.80 | 1.79 | 5 | 0.20 | 0.40 |
| *Melita* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Melita californica* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.80 | 1.79 | 5 | 0.20 | 0.40 |
| *Melita dentata* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Micranellum crebrincinctum* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Mysella tumida* | 0.00 | 0.00 | 5 | 0.60 | 0.89 | 5 | 0.20 | 0.45 | 5 | 1.00 | 1.41 | 5 | 0.45 | 0.44 |
| *Naineris quadricuspida* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |

* Taxa dropped from calculation of H', N, and S.

Table C-1 (continued)

| | Category 3 | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Elrington West | | | NW Bay W Arm | | | Shelter Bay | | | Sleepy Bay | | | Category 3 | |
| Taxon | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count | Mean | SD |
| *Neoamphitrite robusta* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| Nereidae | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Nereis* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.05 | 0.10 |
| *Nereis vexillosa* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 1.00 | 1.41 | 5 | 0.20 | 0.45 | 5 | 0.30 | 0.48 |
| *Nereis zonata* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.40 | 0.89 | 5 | 0.00 | 0.00 | 5 | 0.10 | 0.20 |
| *Nerilla digitata* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Odostomia* | 0.20 | 0.45 | 5 | 0.20 | 0.45 | 5 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.15 | 0.10 |
| *Ophelia limacina* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.05 | 0.10 |
| *Orbiniella nuda* | 2.40 | 2.79 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.60 | 1.20 |
| *Owenia fusiformis* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| Oweniidae | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Paramoera sp. 1* | 0.00 | 0.00 | 5 | 1.60 | 1.52 | 5 | 3.20 | 3.96 | 5 | 0.00 | 0.00 | 5 | 1.20 | 1.53 |
| *Paramoera sp. 2* | 6.00 | 11.77 | 5 | 0.00 | 0.00 | 5 | 15.00 | 7.97 | 5 | 1.40 | 1.67 | 5 | 5.60 | 6.77 |
| *Pectinaria granulata* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.40 | 0.89 | 5 | 0.10 | 0.20 |
| *Phascolosoma agassizi* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Pherusa plumosa* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Pholoe minuta* | 1.20 | 1.79 | 5 | 14.80 | 11.12 | 5 | 2.80 | 3.27 | 5 | 0.80 | 1.10 | 5 | 4.90 | 6.66 |
| Phoxocephalidae | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| Platyhelminthes | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.05 | 0.10 |
| *Platynereis bicanalicula* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| Polychaeta | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.05 | 0.10 |
| *Polydora brachycephala* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Polydora giardi* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Polydora quadrilobata* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Polydora socialis* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| * Polynoidae | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.05 | 0.10 |
| *Priapulus caudatus* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Prionospio cirrifera* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.80 | 1.79 | 5 | 0.20 | 0.40 |
| *Prionospio steenstrupi* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Protodorvillea gracilis* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Protothaca staminea* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.60 | 1.34 | 5 | 0.20 | 0.45 | 5 | 0.20 | 0.28 |
| *Pygospio elegans* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Rhynchospio glutaea* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |

* Taxa dropped from calculation of H', N, and S.

**Table C-1 (continued)**

| | Category 3 | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Elrington West | | | NW Bay W Arm | | | Shelter Bay | | | Sleepy Bay | | | Category 3 | |
| Taxon | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count | Mean | SD | Count | Mean | SD |
| * Rissoidae | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| * Sabellidae | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Saccocirrus eroticus* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.60 | 0.89 | 5 | 0.20 | 0.28 |
| *Saxidomus gigantea* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.05 | 0.10 |
| *Scalibregma inflatum* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.05 | 0.10 |
| *Scolelepis squamatus* | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.10 | 0.12 |
| *Sphaerodoropsis sphaerulifer* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Sphaerosyllis pirifera* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.05 | 0.10 |
| *Spinulogammarus subcarinatus* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.40 | 0.55 | 5 | 0.10 | 0.20 |
| *Spio* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.20 | 0.45 | 5 | 0.05 | 0.10 |
| *Spio filicornis* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.60 | 1.34 | 5 | 0.15 | 0.30 |
| * Spionidae | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Syllis elongata* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 2.00 | 3.46 | 5 | 0.50 | 1.00 |
| *Tellina* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| *Tellina modesta* | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| Tellinidae | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| Terebellidae | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |
| Turbellaria | 0.40 | 0.55 | 5 | 0.20 | 0.45 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.15 | 0.19 |
| | | | | | | | | | | | | | | |
| Mean diversity (H') | 1.20 | | | 1.00 | | | 1.21 | | | 1.65 | | | 1.27 | 0.27 |
| Mean abundance (N) | 30.60 | | | 23.38 | | | 26.08 | | | 46.81 | | | 31.72 | 10.49 |
| Mean number of taxa (S) | 6.00 | | | 4.44 | | | 5.65 | | | 8.80 | | | 6.22 | 1.84 |
| | | | | | | | | | | | | | | |
| Meiofauna | | | | | | | | | | | | | | |
| Harpacticoida | 0.00 | 0.00 | 5 | 0.80 | 1.79 | 5 | 0.60 | 0.89 | 5 | 1.60 | 3.05 | 5 | 0.75 | 0.66 |
| Nematoda | 7.40 | 7.02 | 5 | 12.20 | 11.23 | 5 | 13.00 | 9.41 | 5 | 9.00 | 7.97 | 5 | 10.40 | 2.64 |
| Oligochaeta | 12.80 | 20.28 | 5 | 0.20 | 0.45 | 5 | 33.20 | 23.21 | 5 | 2.00 | 2.55 | 5 | 12.05 | 15.16 |
| Ostracoda | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 | 5 | 0.00 | 0.00 |

* Taxa dropped from calculation of H', N, and S.